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# AN ACCOUNT OF A "BLACK APHID," *APHIS ULICIS* WALKER, 1870 (HEMIPTERA, APHIDIDAE).

By F. H. Jacob.

(*Ministry of Agriculture and Fisheries, National Agricultural Advisory Service, Bangor.*)

Walker (1870) mentions an aphid living on *Ulex europaeus*; his words may be quoted: "*A. Genistae* (S.S. 1298). I believe that this and *A. Laburni* are identical, though the latter is much more shining, especially in the disc of the body. A much smaller *Aphis* which lives on the furze may be termed *A. Ulicis*. It is sometimes like *A. laburni* in colour, sometimes like *A. Rumicis*." The writer is indebted to Dr. Hille Ris Lambers for drawing his attention to this description in time to prevent this aphid from being described as new. As Walker's description is quite inadequate the species is here redescribed.

Buckton (1879) gives *Aphis ulicis* Fabricius ? as a synonym of *Aphis rumicis* L., and notes that it is a "shining black and deeply pitted" species, and Theobald (1927) includes *A. ulicis* Fabricius in the synonymy of his *A. rumicis* L., and *Ulex europaeus* in the list of host-plants of his *A. rumicis*. However, as pointed out by Theobald (1929) and Lambers (1934), Fabricius did not give the name *A. ulicis* to any aphid. Theobald (1929) states that both *A. rumicis* and *A. laburni* Kaltenbach occur on *U. europaeus*, but Hille Ris Lambers (1934) points out that there is a distinct species on this host, and that *A. laburni* only occurs on *Cytisus laburnum*. Theobald's *A. rumicis* partim is a synonym of *Aphis fabae* Scopoli, which is not known to occur on *U. europaeus* (Hille Ris Lambers (1934) and the writer's observations). Thomas and Jacob (1940) record this *Ulex* aphid as *Doralis medicaginis* (Koch), but Jacob (1945) queries this record. *Aphis ulicis* Walker does not agree with Franssen's (1930) description of the "*Medicaginis* group," and in several important features differs from specimens of *A. craccivora* Koch taken on *Medicago sativa*, which were lent to the writer by Dr. D. Hille Ris Lambers. The most outstanding of these differences is the presence on *A. craccivora* of very large marginal tubercles on the prothorax, and the first and seventh abdominal segments, and large marginal tubercles on segments 2, 3, 4, 5 and 6. Apart from those on the prothorax, and first and seventh abdominal segments, marginal tubercles are rarely present on *A. ulicis*.

*A. ulicis* is widely distributed and, in some seasons, quite common: it is extraordinary that it has not been adequately described.

*Aphis ulicis* F. Walker, 1870.

Fundatrix.

Only three specimens available.

*Living specimen*: Black, with a slight coating of powdery wax. Similar to apterous viviparous female, but the antenna is five-jointed, although the comparative length suggests that the third joint is a non-divided third and fourth joint.

*Macerated specimen*: Very similar to apt. v. ♀. Tergum reticulated with a large pigmented sclerotic area on abdomen. Antenna five-jointed: I and II, tip of IV, and V strongly pigmented, remainder colourless or faintly pigmented; III is about $1\frac{1}{4}$ times as long as V, and about twice as long as IV or the processus terminalis, which are about equal in length. Siphunculi relatively much shorter than in apt. v. ♀; they are about equal in length to the cauda, or slightly shorter. Last rostral joint sharply pointed, about $1\frac{3}{7}$ as long as the second joint of the hind tarsus.

*Measurements of a single macerated specimen*: Length of body, 2·33 mm.; antenna, 0·89 mm.; siphunculi, 0·25 mm.; cauda, 0·25 mm.; Proportion of antennal joints $\frac{100}{III}:\frac{49}{IV}:\frac{29+44}{V}$. Appendages in each stage measured on right-hand side of body.

## Apterous viviparous female.

*Living specimen*: The colonies of this aphid are silvery grey owing to the presence of a coating of grey wax on all immature stages, except those aphids which have just completed an ecdysis. In these colonies, early in the season the apt. v. ♀♀ are conspicuously black and shiny owing to the virtual absence of wax; occasionally, and particularly later in the season, they may have a slight powdering of grey wax, but are always shiny. The degree of shininess depends on the intensity of the light—*e.g.*, in bright sunshine the shininess is very greatly enhanced. Ventrally there is more powdery wax. Head and antennal joints I and II, tip of V and VI black, remainder of antenna colourless. Siphunculi and cauda black. Legs normal. Rostrum very pointed.

*Macerated specimen*: Tergum sclerotic, very heavily pigmented and strongly reticulated. Head dark, front convex, with very small antennal processus. Antennal joints I and II dark, III, IV and basal $\frac{1}{2}$–$\frac{2}{3}$ of V colourless, rest of V and VI dark. III is slightly longer to $1\frac{1}{2}$ times as long as the processus terminalis, which is $2\frac{1}{7}$–$2\frac{2}{7}$ times as long as base of VI; IV and V about equal. Thorax with large black sclerites; marginal sclerites on pro- and mesothorax, ventral sclerites in front of first and second coxae, and irregular dorsal sclerites, least well developed on metathorax. Large dark marginal tubercles on prothorax and abdominal segments 1 and 7, but very rarely on intermediate segments in any of the specimens examined. Coxae, trochanters, femora, tips of tibiae and tarsi dark, greater part of tibiae colourless. Siphunculi and cauda black; the former tapering and strongly imbricated; cauda about $\frac{5}{6}$–$\frac{7}{6}$ as long as the siphunculi, generally with 9–14 hairs arranged in pairs, often with 5 on each side, the distal pair being dorsal and subapical. Subgenital plate with 2–6 hairs in anterior group and about 12–16 along the latero-posterior margin. Dorsal hairs sparse, but fairly thick; spinal hairs occur singly, they are wide apart on segments 2, 3 and 4, and much closer together on 5, 6, 7 and 8; marginal hairs generally single. Rostrum reaches to third coxae, the last joint being conspicuously long and pointed; it is about $1\frac{1}{4}$ times as long as the second joint of the hind tarsus.

*Measurements of a single macerated specimen*: Length of body, 1·85 mm.; antenna, 1·24 mm.; siphunculi, 0·41 mm.; cauda, 0·23 mm. Proportion of antennal joints: $\frac{100}{III}:\frac{71}{IV}:\frac{68}{V}:\frac{38+82}{VI}$.

## Alate viviparous female.

*Living specimen*: Black, with a slight powdering of wax mainly ventrally.

*Macerated specimen*: Generally strongly pigmented. Abdomen with faint reticulations and wide dark sclerotic transverse bars on each segment, those on 5, 6, 7 and 8 reaching the marginal sclerites; a small marginal sclerite on 1, large sclerites on 2, 3, 4. The dorsal sclerotisation may be very much reduced, probably as a result of poor feeding conditions. As in the other stages, there are fairly large intersegmental dorsal sclerites in the pleural region and smaller ventral sclerites. Antennae dark, with the very base of III lighter, III about equal to or slightly longer than the processus terminalis, which is about $2\frac{1}{4}$–3

times as long as base of VI, IV and V approximately equal; III with 4–8 secondary rhinaria, IV occasionally with I. Legs dark, with major part of tibiae colourless. Siphunculi and cauda black; the former tapering and strongly imbricated. Cauda approximately $\frac{2}{3}$–$\frac{4}{5}$ as long as siphunculi, with about 12 hairs, 4 on each side on basal $\frac{3}{4}$ and 4 on distal $\frac{1}{4}$, but this is variable, as in apt. v. ♀. Subgenital plate with 2–6 hairs in anterior group and 12–14 on posterior and lateral margins. Last joint of rostrum very pointed, about $1\frac{1}{4}$ times as long as the second joint of the hind tarsus. There are large marginal tubercles on prothorax and abdominal segments 1 and 7, but very rarely on intermediate segments. Generally 2 hairs on each of second, third and fourth marginal plates. Otherwise, chaetotaxy as in apt. v. ♀. Wing veins with dusky margins.

*Measurements of a single macerated specimen*: Length of body, 2·13 mm.; antenna, 1·40 mm.; siphunculi, 0·31 mm.; cauda, 0·21 mm. Proportion of antennal joints: $\frac{100}{III}, \frac{70}{IV}, \frac{75}{V}, \frac{35+90}{VI}$. Secondary rhinaria on antenna: $\frac{6 \text{ and } 7}{III}, \frac{0 \text{ and } 0}{IV}$.

## Alate male.

*Living specimen*: Like a small specimen of the al. v. ♀.

*Macerated specimen*: Similar to al. v. ♀ but pigmented sclerotic cross bars are not present on segments 1, 2, 3, 4, 5 and 6 of the abdomen, and the cuticle is not obviously reticulated. Marginal sclerites on segments 2, 3 and 4 are large, and there are moderately large ante- and post-siphuncular sclerites. There are narrow transverse pigmented bars on segments 7 and 8 and small irregular patches elsewhere. Antennae dark, III slightly shorter to slightly longer than processus terminalis, which is approximately $2\frac{1}{4}$–3 times as long as base of VI, IV equal to or slightly longer than V. III with 12–25, IV with 4–9, V with 6–12 rather small secondary rhinaria. Second joint of hind tibiae about $\frac{7}{9}$ as long as the last joint of the rostrum. Legs as in apt. v. ♀. Siphunculi and cauda black. Siphunculi rather short, cylindrical, about equal in length to cauda, imbricated on about the basal $\frac{5}{8}$. Cauda bears 7–12 hairs, generally an even number regularly arranged in pairs. Chaetotaxy similar to al. v. ♀.

*Measurements of a single specimen*: Length of body, 1·53 mm.; antenna, 1·27 mm.; siphunculi, 0·13 mm.; cauda, 0·13 mm. Proportion of antennal joints: $\frac{100}{III}, \frac{83}{IV}, \frac{77}{V}, \frac{37+106}{VI}$. Secondary rhinaria on antenna: $\frac{18 \text{ and } 22}{III}, \frac{9 \text{ and } 6}{IV}, \frac{8 \text{ and } 12}{V}$,

## Oviparous female.

*Living specimen*: Black with a slight covering of mealy wax.

*Macerated specimen*: Tergum sclerotic, pigmented and reticulated, but pigment is less extensive than in apt. v. ♀. Most characters as in apt. v. ♀. Antenna six-jointed; III equal to or slightly longer than IV, IV and V of approximately equal length, processus terminalis about 2–3 times as long as base of VI. Last joint of rostrum about $1\frac{1}{4}$ times as long as the second joint of the hind tibiae. Hind tibiae are distinctly to strongly swollen, with many small pseudosensoria (as many as 100). Siphunculi about $1\frac{1}{3}$ times as long as cauda, but short in relation to those of apt. v. ♀. Cauda with 14–18 hairs. Subgenital plate may be divided, or entire which in this group suggests intermediates between apterous viviparous and oviparous females; always with many hairs. Chaetotaxy similar to apt. v. ♀, but pleural hairs generally present. There are 8 or 9 hairs across eighth abdominal tergite, and a fairly compact marginal group of 4–6 hairs on each side of this segment. A similar condition is less distinct in *A. craccae* but absent in *A. laburni* and *A. sarothamni*.

*Measurements of a single macerated specimen*: Length of body, 2·06 mm.; antenna, 1·06 mm.; siphunculi, 0·26 mm.; cauda, 0·20 mm. Proportion of antennal joints: $\frac{100}{III}, \frac{85}{IV}, \frac{85}{V}, \frac{54+108}{VI}$. Pseudosensoria on hind tibiae: 102 and 103.

Eggs are rather large, dull orange when just laid, turning black in a few days.

## Biology and distribution.

Found on *Ulex europaeus* throughout the year, possibly also on other species of *Ulex*. Newly hatched eggs were found in Northumberland on 26.iv.44 together with first and second instar fundatrices ; adult fundatrices were found about 12.v.44 ; fairly numerous alatae were taken in Caernarvonshire on 9.vi.46 ; alate males in Caernarvonshire 2.ix.40 ; oviparous females and males in Northumberland 24.ix.43 ; oviparous females in Northumberland 26.xi.43. *A. ulicis* has also been found in Anglesey, Flintshire and Cumberland.

During the summer the aphids form large colonies on the young shoots, feeding on the shoots and leaves. Eggs are laid all over the shoots and at the bases of the leaves. This species is attended by numerous ants which heap soil and debris over any colonies which occur at ground level. The species is myrmecophilous.

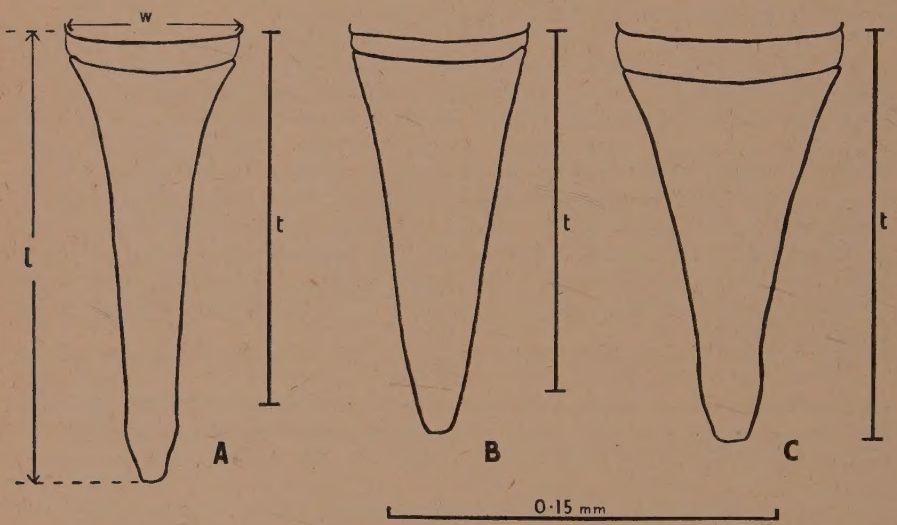


Fig. 1.—Diagram of the ultimate rostral joints of (A) *A. ulicis*, (B) *A. laburni*, (C) *A. sarathamni*. Drawn to scale from a single apt. v. ♀ of each species. Other lettering as in Table 1.

## Notes.

*A. ulicis* appears to belong to a well-defined group of "black aphids" which includes *A. laburni* Kaltenbach, *A. sarothamni* C. J. H. Franssen 1928, *A. genistae* Scopoli, *A. craccae* L., and possibly *A. callunae* Theobald, of the species which are known to occur in the British Isles : of these species *A. genistae* is said by Theobald (1927) to be rare, and has not been found by the writer. Franssen (1928) separates a further species living on *Vicia hirsuta* (L.) S. F. Gray which he calls *A. viciae* Fabricius, and which according to him differs from *A. craccae* in the relative lengths of the siphunculi and cauda : siphunculi slightly longer than the cauda in *A. craccae* and slightly shorter in *A. viciae*. However, D. Hille Ris Lambers points out (*in. litt*) that the name *A. viciae* Fabricius being nothing more than a different way of writing *A. viciae*

*craccae* L., is therefore not available, but is a full synonym of *A. craccae* L. He also indicates that the differences which according to Franssen exist between his so-called *A. viciae* Fabricius and *A. craccae* L. are not constant in Dutch material, where specimens from both *Vicia cracca* L. and *V. hirsuta* occur with the cauda longer than the siphunculi or very little shorter. This is certainly true of English specimens from *V. cracca* : the question of synonymy is made quite clear by reference to Fabricius (1781). Theobald's (1927) *A. laburni* Kaltenbach probably includes *A. sarothamni*, as according to him this species is common on *Cytisus scoparius*, although the writer has found this species on *C. scoparius* (also on *Spartium junceum* and *Genista aetnensis*) growing near colonies of the aphid. Theobald (1927) describes *A. genistae* and *A. callunae* but not *A. craccae* ; however, he includes synonyms of *A. craccae* (*A. viciae* Fabricius and *Craccifex* Amyot) in the synonymy of *A. rumicis* L. It is hoped to include a full description of *A. craccae* in a later paper.

This group of aphids is characterised by a number of features : (1) The presence of a covering of powdery wax in the immature and apterous stages ; this is very well developed in the apterae of *A. laburni* and *A. craccae*, but poorly developed in *A. ulicis*. (2) The absence in nymphs of transverse wax bands on the abdomen. (3) The tergum is sclerotic and conspicuously reticulated in the apterae of each species ; with the exception of *A. callunae* it is also more or less extensively pigmented. (4) Large marginal tubercles occur on the prothorax and the first and seventh abdominal segments ; they are generally absent on other segments, and if present they are small. This is in contrast to the group of "black aphids" including *A. craccivora* Koch and *A. loti* Kaltenbach which also inhabit Leguminosae. (5) These aphids tend to show a preference for the young stems of their hosts, but do occur on leaves, seed-pods, etc., and with the exception of *A. callunae* live exclusively upon Leguminosae. On this evidence *A. callunae* might reasonably be placed in another group.

In this group the tip of the rostrum tends to be sharply pointed, a feature which, while it does not distinguish the group from other "black aphids," is of specific value, and appears to be correlated with the degree of woodiness of the specific host-plant.

*A. craccae*, *A. callunae* and *A. genistae* (judging from Theobald's (1927) description) can be separated from the other members of the group by means of the relatively short thick siphunculi, which are generally shorter than the cauda : in *A. craccae*, as already stated, they may be longer or shorter. These aphids may be readily distinguished one from the other.

*A. ulicis*, *A. laburni* and *A. sarothamni* are much more difficult to separate. The relative proportions of the siphunculi and cauda, the antennal joints, size, and degree of pigmentation are very variable in each species and overlap, so that in small samples they do not afford reliable specific characters. The most constant differences have been found in the shape of the last rostral joint, and in the comparison of its length with the length of the second joint of the hind tarsus. In this respect two characters have been used : (*a*) The comparison of the

length of the last rostral joint with the distal width of the penultimate joint ; (*b*) the above comparison with the hind tarsus. In practice the first measurement is difficult to use because the rostrum often becomes twisted in mounting, and the width varies very considerably with the method of preparation.[1] The basal width of the last joint shows a greater contrast but is more difficult to measure ; see Table 1 and Fig. 1.

**TABLE 1.**

Comparison of the distal width of the ultimate rostral joint (*w*) with the length of the last joint (*l*), and of this length with the length (*t*) of the second joint of the hind tarsus in apterous viviparous females of *A. ulicis*, *A. laburni* and *A. sarothamni*.

| | *w* | *l* | *l* | *t* |
|---|---|---|---|---|
| *A. ulicis* | 100 | 225–280 | 100 | 75–85 |
| *A. laburni* | 100 | 200–220 | 100 | 90–100 |
| *A. sarothamni* | 100 | 165–210 | 100 | 90–100 |

The apterae of *A. ulicis* and *A. sarothamni* are generally but not invariably more heavily pigmented than those of *A. laburni*.

The hind tibiae of the oviparous females of *A. laburni* are not swollen and not pigmented throughout their length ; they bear only a small number of pseudosensoria ; those of *A. ulicis* and *A. sarothamni* are distinctly to strongly swollen, heavily pigmented and bearing a moderate to large number of pseudosensoria.

Acknowledgments.

The writer wishes to express his sincere thanks to Dr. D. Hille Ris Lambers for the loan of slides and for his valuable discussion of problems relating to the "black aphids" ; and also to Mr. J. P. Rogerson for much help in collecting material.

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[1] The material discussed in this paper has been prepared by Roepke's method (see Jacob 1945).

# *COENAGRION CASTELLANI*, A NEW SPECIES OF DRAGONFLY IN EUROPE (ORDER ODONATA, ZYGOPTERA)

By J. E. H. Roberts, O.B.E., F.R.C.S., F.R.E.S.

Following on the discovery of *Coenagrion scitulum* (Rambur), in Essex in 1946, the specimens being somewhat atypical, I wrote to Dott. Caesare Conci, asking him if he could kindly send me specimens of the typical European form to compare with the newly found British ones. In due course a number of *Coenagrion* reached me from this source: some were examples of both sexes of *C. caerulescens* (Fonscolombe) whilst the others had been determined as *C. scitulum* (Rambur). When, however, I came to examine these latter, I found to my surprise that they differed materially from the published descriptions, and to such an extent that it was evident that a wrong determination had been made. Miss C. Longfield, who examined the specimens, pointed out that the superior anal appendages were longer than the inferior appendages and so the species must be new. They resembled *C. mercuriale* (Charpentier) and *C. caerulescens* more closely than *C. scitulum* but, at the same time, could not be reconciled with either of the two former.

It is over eighty years since the last new species of Zygoptera (*C. concinnum* (Joh., 1859)) was described from Europe, so that it is rather surprising that a new species has now turned up in a suburb of Rome. I have to thank Dott. Caesare Conci for sending the specimens which were collected by Signor Omero Castellani, and I have much pleasure in naming the new species after its collector. Owing to my prolonged illness, Lt.-Col. F. C. Fraser, who kindly made the text-figures illustrating this paper, has also consented to read the manuscript and arrange for its publication for me, for which my thanks are due to him.

### **Coenagrion castellani** sp. n.

Male. Abdomen 26 mm. Hind-wing 18 mm. Pterostigma 1·0 mm.

Head: labium pure white, labrum pale blue with base narrowly black, genae, anteclypeus and frons pale blue, postclypeus and whole of upper surface of head dull black, the black extending forwards medially to become almost confluent with that of postclypeus and limited anteriorly by the level of the roots of antennae which are themselves black. The occiput with a medial transverse line of pale blue slightly separated from large pyriform blue postocular spots. Beneath head dull black with a rather broad pale blue fascia bordering the eyes. Prothorax black on dorsum, pale blue laterally, a large subdorsal spot on anterior lobe, a still larger one on the middle lobe and the borders of the posterior lobe save at its middle pale blue. Posterior lobe a little elevated, bilobate, emarginate at centre. Thorax black on dorsum to slightly posterior of the humeral suture, pale blue laterally thereafter: narrow, complete azure blue antehumeral stripes slightly separated from the humeral suture and slightly constricted in the upper third. Laterally a narrow black stripe on the first lateral suture deficient in its lower two-thirds, and a small black spot at the upper end of the second lateral suture, the suture below finely mapped out in black. The blue and the black continued anteriorly on to the mesinfraepisternum. Legs pale blue, all femora strongly marked with black on the outer side, this broadening distally: flexor surface of tibiae and all spines and claws black. Wings hyaline: 10-11 postnodals in the fore-wing,

9-10 in the hind : pterostigma black but a fine white line between the central core of black and the bordering black veins : proximally and distally acute but more so distally, the sides markedly unequal and costal side at least one-third longer than the posterior. Abdomen pale azure blue marked conspicuously with black as follows : segment 1 with a broad quadrate dorsal spot, segment 2 with a broad dorsal spot resembling that of *C. mercuriale* (Charpentier) but with the sides less indented and the arms more generally confluent with the body of the spot or, in some specimens, entirely confluent ; segment 3 with a moderately broad dorsal stripe extending for the apical half of segment, broadening basally and terminating in three points or a central point flanked by outer rounded lobes ; apically

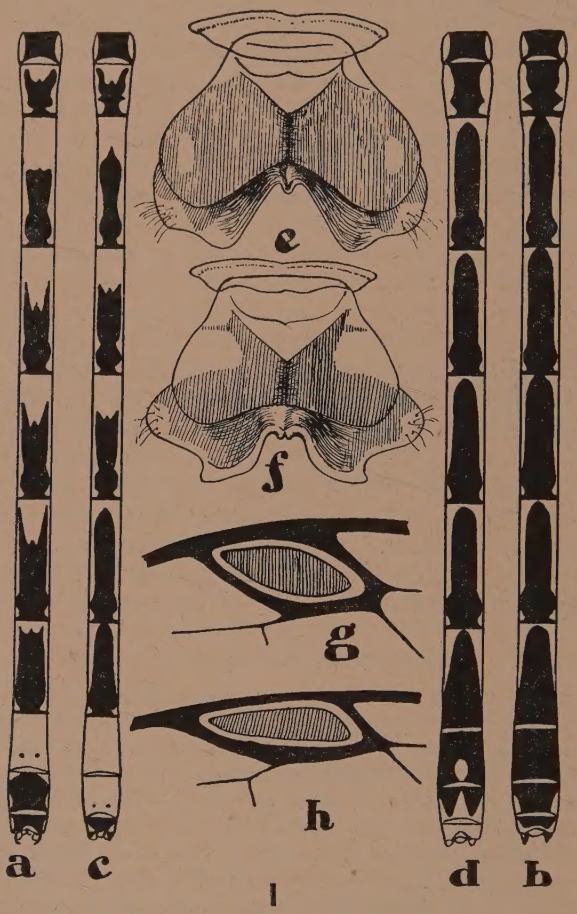


Fig. 1.—Abdominal markings of :—*a*, *Coenagrion castellani* sp. n. ♂ ; *b*, the same of the ♀ ; *c*, *C. caerulescens* (Fons.), ♂ ; *d*, the same of the ♀ ; *e*, prothorax of *C. castellani*, ♀ ; *f*, the same of *C. caerulescens*, ♀ ; *g*, pterostigma of fore-wing of *C. castellani*, ♀ ; *h*, the same of *C. caerulescens*, ♀. (Both drawn to the same scale.)

this stripe shows a broad dilatation before becoming confluent with an apical black ring ; segments 4 to 6 with similar black dorsal stripes but the sides prolonged basally in long tapering points and the centre as a much shorter point prolonged along the mid-dorsal carina : these stripes becoming longer from segment to segment and almost extending to base of segment on the sixth ; segment 7 ending basally in three short equal points ; segment 8 azure blue throughout and with or without two small black subdorsal subapical

points ; segments 9 and 10 broadly black on dorsum, the latter segment concave apically, the concavity conspicuously pale blue. Anal appendages glossy black save for the broad internal laminae of the superiors and the base of the inferiors which are pale blue : superiors about as long as segment 10 and much longer than the inferiors, narrowly cylindrical but a little broader at base, the apical ends curled inwards like a shepherd's crook and ending in an acute point ; inwardly a broad oval flattened lamina which is attached to the basal three-fourths of the stem of appendage. Laterally this appendage appears as a broad cone obtusely pointed at apex and with the lamella showing as a rounded protuberance beneath. Inferior appendages very broad at base and closely apposed at that level, furnished with a short inwardly curled basal black spine and a much longer conical, slightly sinuous, upwardly and posteriorly directed spine equal to about half the length of the superiors.

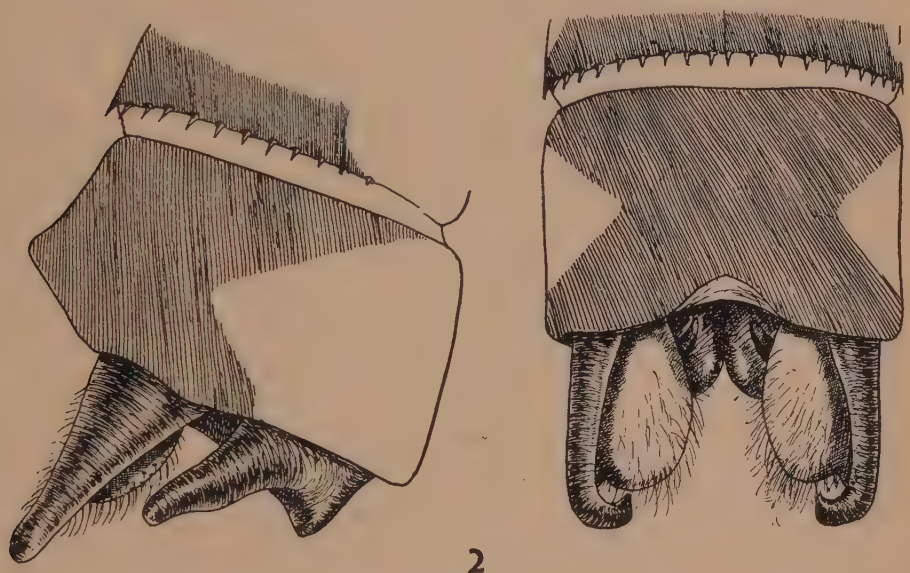

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Fig. 2.—Anal appendages of *C. castellani* sp. n., ♂, right lateral and dorsal views.

Female. Abdomen 25 mm. Hind-wing 20 mm.

Markings of head, thorax and legs entirely similar to those of the male but the ground-colour pale olivaceous. Prothorax with the anterior lobe pale save at its base which is black ; the dorso-lateral spots of midlobe much reduced or almost obsolete ; posterior lobe raised at its middle to form an obtuse keel and deeply emarginate at its centre. Wings hyaline : 12 postnodals in fore-wings, 10 in the hind ; pterostigma pale olivaceous with darker centre, very narrow and elongate, much tapered and acute distally, costal side considerably longer than the other sides. Abdomen with the black markings broader than in the male ; segment 2 with the space between the forks filled in with black and extending right up to base so as to leave a broadly interrupted basal blue ring (the marking subject to considerable variation, however, and, in some, ending in a basal point which just meets base of segment) ; segments 3 to 7 with the dorsal stripes extending right up to bases of segments and the lateral forks entirely obliterated, the ground-colour forming interrupted basal blue rings ; segments 8 and 9 and the base of 10 broadly black. Anal appendages black, shortly conical ; vulvar scales robust, not extending beyond end of abdomen, pale bluish.

Habitat : Italy, Acilia, Rome, 5 males and a single female collected by O. Castellani, 22.v.46 to 1.vi.46. This new species lies nearest to *C. mercuriale* (Charpentier) and *caerulescens* (Fonscolombe), but perhaps more closely to the former, the anal appendages of the two being closely similar. In *mercuriale*, however, the superior and inferior appendages are of approximately the same length, and the markings on segments 3 and 4 are of a very different shape. In *caerulescens*, male, segment 9 is entirely blue and the markings on segments 2 and 3 approximate to those of *mercuriale*. *C. scitulum* (Rambur) has the dorsal marking on segment 2 U-shaped, and those on segments 3 to 5 are without the lateral tapered extensions, ending basally in three short equal points : lastly, segment 9 is for the greater part azure blue. The females are more difficult to separate, but the narrow elongated pterostigma is very characteristic of the new species, and the posterior lobe of the prothorax is shaped more as in *C. pulchellum* than in either *mercuriale*, *caerulescens* or *scitulum*. The type will be deposited in the British Museum collection.

# ON SOME NEW OR INTERESTING IRANIAN ACRIDIDAE (ORTHOPTERA).

By G. Bey-Bienko, D.Sc.
(*Agricultural Institute of Leningrad.*)

The present paper contains descriptions of six new forms of Acrididae and notes on distribution and synonymy of some previously known species. The larger part of these forms was collected by the late Dr. S. A. Predtetshensky in 1930-1931 during his investigations of the Desert locust in Iran.

The types of the new forms will be deposited in the Zoological Institute of the Academy of Sciences of U.S.S.R.

## **Duroniella iranica** sp. n. (figs. 1 and 2).

♂. Antennae distinctly longer than head and pronotum together, 21-jointed, flattened and distinctly expanded in basal quarter, third and fourth segments very short, partly fused, forming a relatively short segment, fifth segment short, strongly transverse, sixth subquadrate, seventh and eighth partly fused, forming an elongated segment, ninth quadrate, the rest about twice as long as broad. Head with upper surface smooth ; frontal ridge not punctured, strongly sulcate and very faintly expanded towards the clypeus, practically parallel-sided ; fastigium of vertex well prominent, distinctly longer than broad, apex bow-shaped rounded, surface distinctly concave, with bow-shaped depression well pronounced, median carinula indistinct, lateral carinae parallel-sided in posterior half, their posterior end slightly curved inwards ; occiput with very fine median carinula. Pronotum elongated and slender, not constricted, disc moderately punctured in metazona only ; median keel low ; but acute, lateral keels practically parallel-sided in prozona, slightly divergent in metazona, somewhat less developed at the posterior end ; transverse sulcus placed well behind the middle of pronotum ; posterior margin obtusely-angulate, not rounded ; pleurae faintly rugulose ; sternum with distinct scattered, irregular points, anterior part of the mesosternum moderately rugulose. Elytra not extending beyond the hind knees.

General coloration dirty pale brown, practically uniform, post-ocular dark stripe weak, indistinct ; wings colourless, with darkish veins, hind tibiae dirty brownish.

♀. Larger than male. Antennae short, reaching only the metazona of pronotum, not strongly but distinctly expanded in slightly more than their basal third, the remaining segments round, mostly about half as long again as broad. Frontal ridge weakly punctured, fastigium of vertex about as long as broad, with rounded and obtuse apex, median carinula slight. Metazona of pronotum, including the lateral lobes, more coarsely punctured ; pleurae rugulose.

General coloration slightly darker than in the male ; post-ocular stripe on the head distinct, blackish ; pronotum with a narrow velvety-black stripe along lateral keels ; elytra with a whitish submarginal stripe.

*Lengths in mm.*: body ♂ 16, ♀ 22 ; pronotum ♂ 3·1, ♀ 4·2 ; elytra ♂ 12·5, ♀ 17 ; hind femora ♂ 9·5, ♀ 12·5.

S. Iran : Near shores of the Strait of Oman, W. Mekran, xii.1930, 1 ♂ (type) ; S. Iran and Mekran, xii. 1930, 1 ♀ (*S. A. Predtetshensky*).

This species is very similar to *D. gracilis* Uvarov from Soviet Middle Asia and to the recently described *D. laeviceps* Uvarov (Uvarov, 1938, *Ann. Mag. nat. Hist.* (11) 1 : 372) ; from the latter species it differs

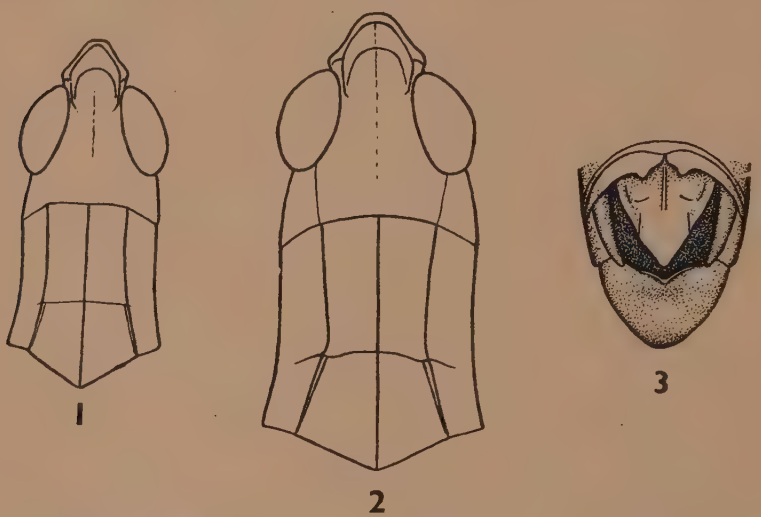
in the more obtuse and longer fastigium of vertex, with more pronounced bow-shaped depression ; in the not swollen head of the female ; in the less divergent lateral keels and some other details of pronotum ; in the coloration of hind tibiae and wings and in less pronounced sexual dimorphism in size. From *D. gracilis* the new species may be easily distinguished by the same details of head and pronotum and in the basally expanded antennae.

It is interesting to note that the new species was captured in winter.

### *Chorthippus pygmaeus* Bey-Bienko.

*Dasyhippus pygmaeus* Bey-Bienko, 1931, *Bol. R. Soc. Esp. Hist. nat.* **31** : 223, figs. 3–4 (♂ ; mountain Shih-yourdy near Ordubad, S. Transcaucasia).
*Chorthippus pygmaeus* Bey-Bienko, 1933, *ibid.* 332 (assignment to new genus).
*Chorthippus savalanicus* Uvarov, 1933, *Trav. Inst. Zool. Acad. Sci. U.S.S.R.* **1** (1932) : 192, fig. 1 (♂, ♀ ; Kutursu, Savalan, N.W. Iran) (**syn. nov.**).

I have studied the authentic series of specimens of *Ch. savalanicus* in the Zoological Institute of the Academy of Sciences of U.S.S.R. as well as the type specimen of my *Chorthippus pygmaeus* and found no differences between them.




Figs. 1–3.—(1) *Duroniella iranica* sp. n. ♂ (type). Head and pronotum, dorsal view. (2) *Duroniella iranica* sp. n. ♀. Head and pronotum, dorsal view. (3) *Dociostaurus diamesus* sp. n. ♂ (type). Apex of abdomen, dorsal view.

### **Dociostaurus diamesus** sp. n. (fig. 3).

♂. A small species of an intermediate position between *D. kraussi* Ing. and *D. brevicollis* Ev. groups. Antennae half again as long as head and pronotum together. Head indistinctly prominent above the pronotum ; frontal ridge strongly narrowing to the fastigium of the vertex, practically parallel-sided at the ocellum, obliterate near the clypeus, sulcation very distinct, seen from above well visible ; fastigium of the vertex strongly sloping forwards, concave, narrow and elongated, a little less than twice as long as broad, with well-raised lateral keels which are quite parallel in the posterior half, anterior angle acute, about 60°, but its immediate apex is slightly rounded ; the width of the fastigium between eyes slightly greater than the maximum width of the frontal ridge at

the ocellum ; foveolae of the vertex distinctly impressed, elongated, nearly twice as long as broad at the middle, moderately narrowing apically, upper and lower margins are quite straight. Pronotum relatively short, subcylindrical, posterior margin indistinctly angulate, almost rounded, lateral keels indistinct in prozona, well developed and subparallel in metazona ; all three transverse sulci well developed, posterior one placed just behind the middle ; lateral lobes indistinctly narrowed downwards, as broad as long, posterior margin slightly oblique but not concave, anterior and posterior lower angles obtuse, rounded. Elytra moderately abbreviated, reaching only the base of the supra-anal plate, narrowing apically, apical part roundly-angulate. Wings distinctly shorter than elytra. Prosternum distinctly swollen ; interspace between mesosternal lobes very broad, equal to the width of each lobe. Last abdominal tergite with obtusely-angulate median excision and with two feeble and small, widely separated, triangular projections (to be seen under great magnification) ; supra-anal plate distinctly elongated, triangular, with the apex not attenuate ; cerci relatively long, slightly incurved ; subgenital plate obtuse, spherical. Hind femora short, 3·3 times as long as broad at the widest part ; arolia between tarsal claws small and narrow.

♀ (paratype). Antennae scarcely longer than head and pronotum together. Frontal ridge quite flat, moderately narrowing to the fastigium of the vertex ; the latter is short, not longer than broad ; foveolae of the vertex scarcely narrowing apically, half again as long as broad. Elytra scarcely reaching the middle of hind femora. Valvae of the ovipositor short, lower pair with rectangular preapical emargination.

General coloration brown. Pronotal metazona with lateral pale stripes distinctly displaced just at the hind sulcus, triangular, but not very broad ; lateral lobes with indistinct black spot. Hind femora with a distinct black spot at the base of the upper part of the inner surface and with two transverse blackish fasciae on the upper surface ; external lower keel without (♂) or with distinct black points (♀) ; knee lobes blackened only in female ; hind tibiae greyish in male, with distinct reddish shade in female, basal part slightly darkened only in female.

*Lengths in mm.*: Body ♂ 12, ♀ 17 ; pronotum ♂ 2·4, ♀ 3·6 ; elytra ♂ 6·3, ♀ 8·2 ; hind femora ♂ 8·3, ♀ 12.

N. Iran : Elburs mountains, Teheran province, 7.vii, 1 ♂ (type), and 13.vi. 1 ♀ (*S. A. Predtetshensky*).

This small species represents a derivation of the group of *D. kraussi* Ing. and *D. hauensteini* Bolivar, but differs well from both in smaller size, structure of the head, especially in the male sex, and in the shape of the last abdominal tergite and the supra-anal plate of the same sex. In the structure of the fastigium of the vertex it resembles *D. tartarus* Stschelk. and *D. brevicollis* Ev., but differs from these species in many features, especially in the shape of hind femora and in the structure of the apex of the abdomen in the male sex.

### *Arcyptera microptera* **elbursiana** subsp. n.

Differs from *A. microptera microptera* F.-W. by larger size, abbreviated elytra, indistinct pale stripes on lateral keels of pronotum and by the coloration of knee part of hind legs, as follows : external and inner knee-lobes of hind femora in male completely black, except the apical third of the lower lobe, in female with blackened basal part of the lower lobe, basal part of hind tibiae black in male, darkened in female. In the general habitus and coloration on the knee part of hind legs the new subspecies resembles somewhat *A. microptera sibirica* Uvarov from Eastern Siberia, but differs from it in smaller size, indistinct pale stripes on the pronotum, and in much abbreviated elytra, which in the male reach only the supra-anal plate and in the female the middle of hind femora.

*Lengths in mm.*: Body ♂ 21·5–23, ♀ 32; pronotum ♂ 5·3–5·4, ♀ 6·4; elytra ♂ 12·7–13, ♀ 13·5; hind femora ♂ 15·5–16·1, ♀ 19.

N. Iran: Elburs, 10.vi.1931, 3 ♂♂ (including the type) and 1 ♀ (*S. A. Predtetshensky*).

*Celes variabilis carbonaria* Uvarov.

Although this subspecies is widely distributed in Southern Transcaucasia, it was never recorded previously from Iranian Azerbaidzhan.

N.W. Iran: Iranian Mugan, v.1946, 1 ♀.

**Farsinella** gen. n.

Related to *Dericorys* Serville, but differs clearly from it in many features.

Antennae short and relatively thick, in female not reaching beyond the middle of the pronotum, rounded in basal half, slightly dilated towards the apex. Head with the face moderately oblique; frontal ridge distinctly projecting above the ocellum, forming a distinct, though obtuse and rounded, angle with the fastigium of the vertex, moderately constricted below the ocellum, slightly expanded and obliterate towards the clypeus; fastigium of vertex strongly sloping, not separated from the frontal ridge, roundly passing into the latter, with distinct transverse concavity at the middle, anterior part dilated, without apical furrow, but with very distinct and short median keel, posterior part with parallel lateral keels; foveolae of the vertex present but small, not quite distinct, irregularly rounded, smooth, with several impressed points. Pronotum short, median keel low, simple, intersected by the typical sulcus near the median point; prozona moderately inflated but without a hump, separated from the metazona by well-defined transverse concavity along the typical sulcus, hind margin broadly rounded; posterior margin of lateral lobes roundly excised, its lower half quite vertical. Prosternum with a very short, obtusely angular tubercle; mesosternal lobes very short, broadly separated, their posterior margin moderately incurved, oblique, inner angle practically undeveloped; metasternal lobes broadly separated. Elytra and wings well developed, venation as in *Dericorys*. Supra-anal plate in female rhomboidal, with very distinct transverse bow-shaped sulcus, apex nearly rectangular; cerci in female very short, conical; last sternite in female with a feeble median excision; valvae of the ovipositor short, the lower ones with a small but very distinct external conical tooth at the base, the upper pair almost concealed. Hind femora relatively slender, hind tibiae slightly incurved and dilated apically, external margin with 10–11 spines, including the apical one, internal margin with 11 more elongated, partly incurved spines, inner spurs slender, relatively long; tarsi slender, posterior tarsus equal in length to one-third of the corresponding tibia, tarsal claws slender, arolia small and narrow.

Genotype: *Farsinella uvarovi* sp. n.

Although the affinity of *Farsinella* to *Dericorys* is quite evident, in the structure of antennae, meso- and metasternum and in the short and broad pronotum the new genus shows some resemblance to North African apterous *Anamesacris* Uvarov. However, the last named genus has no trace of the prosternal tubercle, while in the genus *Farsinella* this tubercle is evident, but exhibits a tendency to disappearance.

**Farsinella uvarovi** sp. n. (fig. 4).

♀. Face seen in profile obtusely excised at the median ocellum; frontal ridge practically disappearing below the latter; upper part strongly prominent, very feebly sulcate; fastigium of the vertex about half again as long as broad, without median keel in posterior half.

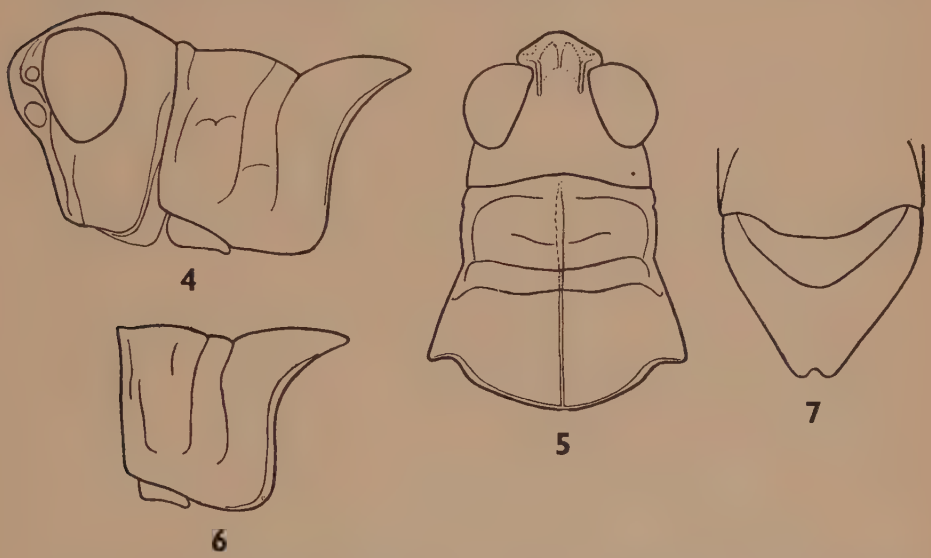
Pronotum practically smooth in the prozona, metazona very finely rugulose, not inflated, slightly sloping anteriorly, median keel very fine, intersected by the second and third (typical) sulcus, the latter is placed in the middle of pronotum. Elytra scarcely extending beyond hind knee, relatively narrow. CuA (anterior ulnar vein) not furcate in apical part; wings relatively broad. Last abdominal sternite with not profound bow-shaped median and well-developed lateral excisions on hind margins; apical part of the lower valvae of the ovipositor quite flat, not incurved. Hind tibiae covered with relatively long, not very dense hairs; hind metatarsus equal in length to the remaining joints.

General coloration very light ochraceous whitish, antennae darkened apically, apical joints brownish yellow with a blackish median longitudinal stripe; elytra with a sparse light brownish spot; wings with a very faint bluish shade; hind femora with two bluish fasciae on the upper side; hind tibiae pale whitish, spines black-tipped.

*Lengths in mm.*: Body 19·8; pronotum 4; elytra 16; hind femora 11·2.

IRANIAN BALUCHISTAN: River Desuk, vi.1930, 1 ♀ (*S. A. Predtetshensky*).

I am very pleased to dedicate this interesting species to Dr. B. P. Uvarov, who has done much fundamental work on the systematics, ecology and zoogeography of Orthoptera.




FIGS. 4–7.—(4) *Farsinella uvarovi* gen. et sp. n. ♀ (type). Head and pronotum, lateral view. (5) *Farsinella predtetshenskyi* gen. et sp. n. ♀ (type). Head and pronotum, dorsal view. (6) *Farsinella predtetshenskyi* gen. et sp. n. ♀ (type). Pronotum, lateral view. (7) *Thisoicetrus bituberculatus* sp. n. ♂ (type). Subgenital plate, ventral view.

### **Farsinella predtetshenskyi** sp. n. (figs. 5 and 6).

♀. Differs from *F. uvarovi* sp. n. as follows: Body somewhat larger, frontal ridge well developed below the median ocellum and disappearing at the clypeus; fastigium of the vertex more elongated, about twice as long as broad, with a very fine median keel in posterior half, transverse concavity more profound, lateral keels more raised. Pronotum with irregular and thick but subobliterate wrinkles in the prozona; metazona finely rugulose, distinctly inflated, its upper surface seen in profile distinctly bow-shaped incurved; median keel well developed, intersected only by the typical sulcus which is placed beyond

the middle of pronotum ; transverse concavity along typical sulcus more developed, profound ; lower margin of the lateral lobes of the pronotum obtusely angulate at the middle. Elytra reaching only the apex of hind femora. Last abdominal sternite with median excision on the hind margin distinctly angular, lateral excisions indistinct, practically absent. Hind tarsi less elongated, their metatarsus slightly shorter than the remaining joints.

General coloration light ochraceous grey, with more distinct dark markings ; apical half of the antennae blackened ; elytra with numerous but scattered blackish spots ; wings with a fine but distinct bluish shade, transverse fasciae on the upper surface of hind femora very distinct, blackish, lower surface of hind tibiae dirty-bluish.

*Lengths in mm.* : Body 22 ; pronotum 4·4 ; elytra 17·5 ; hind femora 13.

South Kirman : ix.1930, 1 ♀ (*S. A. Predtetshensky*).

The species is named after my prematurely deceased friend and colleague, Dr. S. A. Predtetshensky, locust research entomologist of the Institute of Plant Protection, Leningrad.

*Thisoicetrus theodori* Uvarov (?).

The unique specimen agrees well with Uvarov's description and figures of *Th. theodori* described by him from Sinai (1929, Bodenheimer and Theodor, *Ergebnisse der Sinai Expedition* : 102, Taf. XVII, Alb. 6–7) in all essential features and differs only in some details of coloration and morphology, as follows :

Vertex with a fine but distinct longitudinal keel between eyes ; cubital (interulnar) field of elytra without any trace of a false vein ; hind tibiae with 15 external and 13 internal spines ; longitudinal fascia on the upper surface of the insect is very sharp, black, without a pale median line on the head ; elytra with some distinct sparse dark spots, anal area partly darkish, hind tibiae with brownish black basal part divided into two fasciae by a light and narrow incomplete ring, basal part of the second third with a blackish brown fascia, the remaining part light purplish red.

*Lengths in mm.* : Body 16·2 ; pronotum 3·4 ; elytra 14 ; hind femora 10·5.

Present knowledge of *Th. theodori* is very scanty as it is known from a single male type specimen ; it is therefore impossible to make a final determination of the unique Iranian specimen.

N. Iran : Kazvin, 7.ix.1931, 1 ♂ (*S. A. Predtetshensky*).

**Thisoicetrus bituberculatus** sp. n. (fig. 7).

♂. Very similar in general habit, structure and coloration to *Th. littoralis similis* Br.-W. and differs only in structure of the subgenital plate and in less robust hind femora. Subgenital plate slightly more elongated than in *Th. littoralis similis*, subconical with the apex distinctly bi-tuberculate, but tubercles are small, contiguous ; posterior side of the plate, seen in profile, moderately concave. Hind femora slightly more slender than in *Th. littoralis similis*, their length exactly five times as great as the maximum width at the base.

*Lengths in mm.* : Body 21·5 ; pronotum 4·3 ; elytra 18 ; hind femora 13·8.

N. Iran : Veramin, 13.ix.1945, 1 ♂ "on a cotton field."

Although somewhat similar in the structure of the male subgenital plate to *Th. adspersus* Redtenbacher, the new species differs however from it in the less developed and unseparated tubercles on the plate, more robust hind femora, more broadly separated eyes on the vertex, and in the dark dorsal stripe extending to the anal area of elytra.

The type is unique.

# TERMITES OF THE UGANDA PROTECTORATE

By W. Victor Harris, F.R.E.S.

The greater part of the Uganda Protectorate lies within the Guinean Savannah Province of Chapin's classification of Ethiopian faunal areas (Chapin, 1932), the Uganda-Unyoro district forming the easterly extension of the Ubangi-Uelle Savanna. A small area of western Uganda is part of the Lower Guinea Forest, and from the isolated forest "islands" which occur as far east as the Victoria Nile there is reason to suppose that in the past this zone was more extensive. Northern Uganda is part of the East African Highlands district of the East and South African Sub-Region and is characterised by marked wet and dry seasons.

In this annotated list of termites recorded from Uganda there are twenty-five species and of these—

11 are widely distributed in the Ethiopian Region ;
4 are recorded from the Guinea Forest ;
4 are recorded from the Ubangi-Uelle Savanna ;
3 are restricted to Uganda.

Of the remaining three species, two are known from single records in the East and South African Highlands, and one from the Upper Guinea Forest.

In order that this list of species might not give a false impression of the composition of the Uganda termite fauna by the apparent absence of certain widely distributed genera, eight records are listed in Appendix I where specific determinations have not yet been possible, but which belong to genera otherwise not represented.

An index of all localities, with their latitude and longitude, forms Appendix II.

This list is based on the collection of the Agricultural Research Station, Kawanda, made by Messrs. Gowdey and Hargreaves and identified by Professors Sjostedt and Emerson ; and on the writer's personal collection. One new species is described. The nomenclature of Sjostedt's *Revision der Termiten Afrikas* is followed.

I wish to thank Professor Emerson for his assistance, and those correspondents who have been good enough to provide me with specimens from localities not visited by me.

## Calotermitidae.

### **Calotermes mutubae** sp. n.

*Imago.*—Head pale brown, sides parallel, posterior margin well rounded. Labrum completely covers the mandibles. Eyes dark and prominent, nearly circular. Ocelli large, ill defined, touching the eyes. Antennae with 15 segments, 2 being slightly shorter than either 1 or 3. Pronotum as wide as the head, the front margin concave, hind margin slightly emarginate, sides rounded. Abdomen brown above, pale below. Tibiae with three prominent basal spines. Wings pale ; costa, sub-costa, radius and radial sector chitinised and distinct, the remaining veins inconspicuous.

| | mm. |
|---|---|
| Length with wings ... ... ... ... ... | 10·80 |
| Length without wings ... ... ... ... ... | 6·00 |
| Width of head ... ... ... ... ... ... | 1·28 |
| Length of head to base of mandibles ... ... ... | 1·02 |
| Length of head to tip of labrum ... ... ... | 1·54 |
| Diameter of eye ... ... ... ... ... ... | 0·30 |
| Length of pronotum ... ... ... ... ... | 0·70 |
| Width of pronotum ... ... ... ... ... | 1·28 |
| Length of anterior wing ... ... ... ... | 10·80 |
| Width of anterior wing ... ... ... ... | 6·00 |

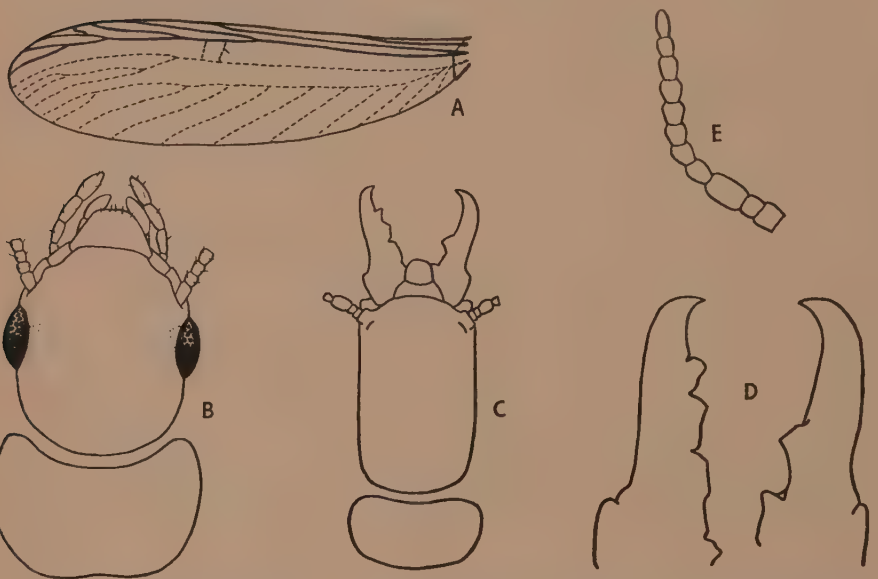



Fig. 1.—*Calotermes mutubae* sp. n. A, anterior wing; B, head and pronotum of imago; C, head and pronotum of soldier; D, mandibles of soldier; E, antenna of soldier.

*Soldier.*—Head reddish yellow, darkening near the articulation of the mandibles; sides parallel and posterior margin lightly rounded. Antennae with 11 segments, 3 being much larger than the rest and cylindrical. Mandibles straight with incurved tips, the bases thickened to a distinct exterior hump, black except near the base. Labrum small, semicircular, with prominent bristles. Pronotum with concave front margin, and lightly emarginate posterior, not so broad as the head.

| | mm. |
|---|---|
| Head with mandibles ... ... ... ... | 3·20–3·68 |
| Length of head ... ... ... ... ... | 2·00–2·40 |
| Width of head ... ... ... ... ... | 1·34–1·44 |
| Length of left mandible ... ... ... ... | 1·20–1·40 |
| Width of pronotum ... ... ... ... | 1·28–1·38 |
| Length of pronotum ... ... ... ... | 0·80–0·83 |

(These measurements indicate the extremes of a series and not two separate castes.)

This species is close to *flavicollis* Fabricius and *durbanensis* Haviland in size and general appearance of the imago. It differs from Tanganyika specimens of *durbanensis* in being paler in colour, having the head more rounded, and having the pronotum narrower in proportion to the head and with more rounded sides. The soldier differs from *durbanensis* in being smaller, in having the second antennal segment cylindrical instead

of clavate, in the absence of serrations along the inner edge of the right mandible between the tip and the median tooth, and in the smaller number of antennal segments.

UGANDA: Kawanda Agricultural Research Station, January, 1947 (No. 475), in dead branch of the bark-cloth tree, *Ficus natalensis*, "mutuba" (*W. V. Harris*). Described from numerous alates and soldiers. Types in the British Museum.

### *Glyptotermes parvulus* Sjostedt.

*Calotermes parvulus* Sjostedt, 1907, *Ent. Tidskr.* **28** : 234.

Kawanda, 1947, Nos. 476, 477 and 489, from dead branches of trees in swamp forest, *Xymalos monospora* and *Conopharyngia holstii*, and the introduced *Poincianna regia*.

Described from Mukimbungu in the Belgian Congo with additional records from the Gold Coast.

Swarming of alates took place from laboratory colonies on a number of afternoons during March between 14.00 and 15.00 hours, sun time. The colonies are found in galleries made in branches that are dry or even slightly sappy, but not where rotting has started.

## RHINOTERMITIDAE.

### *Schedorhinotermes lamanianus* Sjostedt.

*Rhinotermes lamanianus* Sjostedt, 1911, *Ent. Tidskr.* **32** : 141.

Bwamba, 1941, No. 416, from runways on the trunks of forest trees.

Described from Mukimbungu, near the mouth of the Congo, this species is widely distributed in the Belgian Congo, East Africa and as far south as Zululand. It is replaced in West Africa by *S. putorius*, a closely related species.

*S. lamanianus* builds a nest in rotten wood at, or just below, ground level, and frequently between the buttresses or exposed roots of a forest tree. Covered ways are constructed of chewed wood up the tree trunk until either dead branch-stumps are located, or where decay has started in a fork, and here secondary nests are developed. The workers' gut contains a variety of interesting protozoa. Lepidopterous larvae of the family TINAEIDAE are generally found in association with this termite.

## TERMITIDAE.

### *Acanthotermes acanthothorax* Sjostedt.

*Termes acanthothorax* Sjostedt, 1898, *Ent. Tidskr.* **19** : 204.

Bwamba, 1941, No. 420; found in covered run ways leading from the ground up the trunk of a forest tree.

Mpigi, 1947, No. 480; on bark of dead standing forest tree on main road from Kampala to Masaka. Sjostedt (1925) also records it on Bugala, one of the Sese Islands.

The type locality is the Cameroons, and other records come from Portuguese Guinea, Ivory Coast, French Equatorial Africa, and the Belgian Congo. Emerson (1928) states "all of the localities from which

this species has been taken are within or close to the borders of the West African rain forest."

The nest is below ground and foraging workers and soldiers are found in decaying wood or in tunnels of soil running up tree trunks to dead limbs.

The small series from Bwamba and that from Mpigi consist of two soldier forms only, major and minor, with no intermediates.

### *Pseudacanthotermes militaris* Hagen.

*Termes militaris* Hagen, 1858, *Linn. Ent.* 12 : 122.

Lugazi (*Hargreaves*) 1930 ; Kampala (*Hopkins*) 1934 (No. 438); Bukalasa, 1937, No. 316, from covered run ways on tree trunks. Sjostedt (1925) gives Busu, in Busoga.

This termite is widely distributed in Africa south of the Sahara, from French Guinea across to Kenya and south to Angola and Rhodesia. It builds large nests with fungus comb, and under favourable conditions makes an irregular dome-like mound above the surface of the soil.

### *Pseudacanthotermes spiniger* Sjostedt.

*Termes* (*Acanthotermes*) *spiniger* Sjostedt, 1899, *Ent. Tidskr.* 20 : 278.

Kampala (*Gowdey*) 1915 ; Kazinga Flats, 1937, No. 308 "low flattened mounds"; Mubende, 1937, No. 314 ; Kawanda, 1946, No. 460.

Originally described from the Belgian Congo, this species is widely distributed in that country, in the West Coast and in Uganda. In Tanganyika it is restricted to the Lake Tanganyika coastal region. Its distribution in Uganda coincides with that of *Bellicositermes natalensis*.

In Uganda the nests are subterranean, or in irregular flattened mounds from two to three feet high. One mound, reputed to have changed little in the past twenty years, was about four feet at the highest point. Emerson (1928) figures a mound at Avakubi in the Belgian Congo, 13 feet high and 56 feet in width at the base, but it is to be doubted that *P. spiniger* was the original builder.

The winged adults of this termite are a popular item of food throughout the range of its distribution. At swarming time, traps are constructed over the emergence holes, as described by Harris (1940). An analysis of the termites as offered for sale in the markets of the Belgian Congo is given by Tihon (1946).

### *Pseudacanthotermes piceus* Sjostedt.

*Acanthotermes piceus* Sjostedt, 1911, *Ent. Tidskr.* 32 : 173.

Bulemezi (*Hargreaves*) 1933, "nest underground, winged adults come out in the middle of the day" (det. A. E. Emerson—metatype).

This termite is known only from specimens of winged adults. The first and only published record comes from Salisbury, Southern Rhodesia. Its distribution in Uganda appears to be limited to Bulemezi County, where it is known as "naka," and collected as food.

### *Bellicositermes goliath* Sjostedt.

*Termes goliath* Sjostedt, 1899, *Ent. Tidskr.* 20 : 156.

Mityana (*Hargreaves*) 1926, "no mound"; Entebbe (*Symes*) 1946; "large mound on lake shore"; Kikandwa, 1946, No. 466, "large domed mound."

Originally described from the lower slopes of Mount Kilimanjaro in Tanganyika, this species is widely distributed from Tanganyika to the Transvaal in the east, and across the Belgian and French Congo to Dahomey in the west.

It is usual for this species to inhabit massive rounded mounds, the largest built by any African termite. As with the other members of this genus, however, mound building may be suppressed by cultivation, leaving the nests completely subterranean. Fungus gardens of large dimensions are present in the nest. Soil from the interior of these mounds is widely used as a pottery clay. The winged adults are collected for food, though not so systematically as those of *Pseudacanthotermes*, perhaps because they swarm after sunset.

### *Bellicositermes bellicosus* Smeathman.

*Termes bellicosus* Smeathman, 1781, *Phil. Trans. Roy. Soc.* 71 : 141.

Kampala (*Gowdey*) 1909; Masaka (*Hancock*) 1925; Lira (*Cox*) 1942; Lomej, Karamoja District (*Chorley*) 1942; Butiaba, 1946, No. 463; Kawanda, 1946, No. 467; Mbarara, 1947, No. 482.

One of the more widely distributed African termites, it is found from Eritrea and Senegal in the north to the Transvaal in the south. The type of mound which is constructed to house the nest varies with the climate and soil type of the locality. In dry areas the tendency is towards a lofty pinnacle mound. Rough mounds with a number of small turrets are typical of areas with a well-defined wet and dry season. Regular rainfall areas have more domed mounds, which appear to become lower as the annual rainfall increases. In Uganda, *B. bellicosus* becomes a subterranean nest-builder in the wetter areas, being replaced by *B. natalensis* as the dominant mound builder. According to Emerson (1928), *B. bellicosus* in the Congo "seems to be largely confined to the savannah region and has not invaded the rain forest to any great extent."

### *Bellicositermes natalensis* Haviland.

*Termes natalensis* Haviland, 1898, *J. Linn. Soc. Lond.* 26 : 383.

Kampala (*Hargreaves*) 1923; Salalira (*Hargreaves*) 1930; Entebbe, 1941, No. 422; Ngotokwe, Lango District (*Cox*) 1942, "nests apparently underground"; Budongo (*Eggeling*) 1944, "the common grassland termite of Bunyoro"; Masindi, 1946; Tororo, 1937, No. 317; Kazinga Flats, No. 307, 1937; Kawanda, 1946; Busoga District, 1946.

This termite was described from Natal. Prior to 1898 it had been confused with *B. bellicosus*, and still is, without doubt, owing to the similarity of these two closely related species. It is almost as widely distributed in Africa south of the Sahara as *B. bellicosus*, which it appears to replace as the common mound builder in the wetter areas. It is the

dominant mound building termite of the greater part of Uganda, the "Uganda-Unyoro savanna" of Chapin. There is no precise line of demarcation between the zones where *natalensis* and *bellicosus* predominate.

### *Termes rectanguloides* Sjostedt.

*Odontotermes rectanguloides* Sjostedt, *Rev. Zool. Afr.* **12** : 490.

Kawanda, 1946, No. 469, from a nest under a flower bed.

This species was described from the Upper Uelle district of the Belgian Congo. It does not appear to have been recorded elsewhere.

The subterranean nest structure is similar to that of *T. badius*, though no crater-like openings to the surface have been observed as yet. The workers actively remove dry vegetable matter spread on the soil as a mulch.

### *Termes monodon* Gerstäcker.

*Termes monodon* Gerstäcker, 1891, *Jahrb. Hamb. Wiss. Anstalt* **19** : 185.

Kampala (*Hargreaves*) 1933 (det. A. E. Emerson, metatype).

Originally described from Mozambique, this non-mound building termite is recorded from Transvaal, Tanganyika, Zanzibar and Uganda, and to the west at Sankuru in the Central Congo. Confusion with the widely distributed *Termes badius* is not unlikely, owing to the variations in size of that species and the poor development of the diagnostic median frontal ridge in some specimens of *T. monodon*.

### *Termes badius* Haviland.

*Termes badius* Haviland, 1898, *J. Linn. Soc.* **26** : 385.

Inomo, Lando District (*Cox*) 1942 ; Ruwenzori, 7,300 feet (*St. Clair Thompson*) 1942 ; Kawanda, 1946, No. 468. Sjostedt (1925) gives Entebbe.

Since its description from specimens collected in Natal, this species has been recorded widely throughout Africa south of the Sahara and outside of the Tropical Forest zone. It appears to be commonest in the drier areas, but its tolerance of a wide range of climatic conditions is probably greater than any other African termite.

*T. badius* makes large nests with extensive fungus gardens. These nests are usually subterranean, and are indicated by groups of large irregular holes on the surface of the ground, the openings of shafts leading down into the corridors between the chambers. Broad based mounds up to two or three feet high occur in Uganda on uncultivated land bordering swamps. In other places irregular mounds are found built in the shelter of a boulder or against a tree.

### *Termes fulleri* Emerson.

*Termes fulleri* Emerson, 1928, *Bull. Amer. Mus. nat. Hist.* **57** : 465.

Bulechcke (*Hargreaves*) 1930 (metatypes, det. A. E. Emerson).

The type locality for this species is Niangara, in the Upper Uelle area of the Belgian Congo.

### *Termes culturarum* Sjostedt.

*Odontotermes culturarum* Sjostedt, 1924, *Rev. Zool. Afr.* 12 : 492.

Dwoli, near Hoima (*Hargreaves*) 1929 (det. A. E. Emerson).

The only published record of this termite appears to be the original description (and its amplification in Sjostedt, 1925) from Myombo, near Kilosa in Tanganyika Territory.

### *Termes kibarensis* Fuller.

*Termes* (*Odontotermes*) *kibarensis* Fuller, 1923, *Ann. Mag. nat. Hist.* (9) 11 : 192.

Kibara (*Duke*) 1921, type ; Kampala (*Gowdey*) 1915 (type of *Termes ugandanicus* Sjostedt, 1924) ; Masindi (*Hargreaves*) 1932.

The locality "Kibara" cannot be traced. The local name for this particular termite is "kibala," a name which includes other species which have similar funnel-like entrances to their subterranean nests, and in the vicinity of which an edible mushroom is found at certain seasons.

### *Termes nolaensis* Sjostedt.

*Odontotermes nolaensis* Sjostedt, 1924, *Rev. Zool. Afr.* 13 : 492.

Kawanda, 1946, No. 459, from subterranean nests common in cultivated land.

Type locality Nola, French Equatorial Africa. It is also recorded from Iri in Upper Uelle (Sjostedt, 1926).

This species makes small craters around the openings of the air shafts which enable the subterranean nests to be located.

### *Termes latericius* Haviland.

*Termes latericius* Haviland, 1898, *J. Linn. Soc.* 26 : 386.

Serere, 1937, No. 321, "feeding on dead wood on the surface of the ground."

Originally described from Natal, this termite is recorded from widely separated localities from Senegal to the Union of South Africa. In East Africa it was previously known from Tanganyika (Harris, 1936).

The nest is underground and indicated at most by a low flattened mound. The workers are voracious foragers of dry vegetable matter, especially grass stems and mulching material.

### *Labiotermes rhinoceros* Sjostedt.

*Eutermes rhinoceros* Sjostedt, 1905, *Ark. Zool.* 2 (16) : 11.

Toro : 20 miles east of Fort Portal, 1937, No. 312, "occupying an old mound of *Cubitermes ugandensis* in a native garden."

The types of this species were from Mukimbungu in western Belgian Congo, where they were collected together with *Basidentitermes aurivillii* in an old termite mound. Two more species have been described from West Africa and the Congo.

### *Ancistrotermes amphidon* Sjostedt.

*Ancistrotermes amphidon* Sjostedt, 1926, *Ent. Tidsk.* **47** : 240.

Kitgum (*A. M. Gwynn*) 1937, " destroying cotton plants by boring the stems."

Sjostedt describes this species from Accra, Gold Coast, where it was found in what would appear to be an old mound of one of the larger termites. Gwynn's specimens were collected in earth runs built on the stems of cotton plants or in tunnels within the plants.

Of the six species in the genus one is found in the Sudan, two in Southern Africa, and three—including *amphidon*—in West Africa and the Congo.

*A. crucifer* Sjostedt is recorded from Nigeria and the Gold Coast as cutting grass, and ascending the stems of teak in search of dead bark. *A. latinotus* Silvestri has been found to attack cotton at Shinyanga, Tanganyika, in a similar manner to *amphidon*.

### *Microcerotermes edentatus* Wasmann.

*Microcerotermes edentatus* Wasmann, 1911, *Rev. Zool. Afr.* **1** : 115.

Budongo Forest (*Eggeling*) 1944 ; Kyagwe, 1946, No. 473, arboreal nest on rubber tree ; Jinja, 1946, nest on Cassia trees in township ; Kawanda, 1947, No. 478, in swamp forest.

The type locality is Sankuru, Belgian Congo, from which country there are other records. It occurs at Kigoma on the eastern shore of Lake Tanganyika (*Harris*, No. 80).

The nest is more or less spherical, made of carton and attached to the trunk of a tree usually high above the ground. Covered ways on the trunk connecting the nest with the ground and with feeding places in dead branches, serve to distinguish the nests of *Microcerotermes* from similar nests built by ants of the genus *Crematogaster*. In drier country *Microcerotermes edentatus* is replaced by *Eutermes* spp. as a builder of arboreal nests.

### *Microcerotermes parvus* Haviland.

*Termes parvus* Haviland, 1898, *J. Linn. Soc. Lond.* **26** : 404.

Masindi, 1946, No. 462, small carton nest exposed by digging soil beneath mango tree ; Kawanda, 1947, No. 479 ; in fallen tree-trunks and in decaying stumps of branches.

Described from Natal, *M. parvus* is widely distributed from Eritrea and the Sudan south to the Cape, and across to the Gold Coast.

The nest is a honeycomb structure of carton, spherical to rounded-conical in shape, similar to that of *M. edentatus* but situated below ground. Carton tunnels link the nest with branch-stumps and fallen logs, on which the termites feed.

### *Cubitermes ugandensis* Fuller.

*Cubitermes ugandensis* Fuller, 1923, *Ann. Mag. nat. Hist.* (9) **11** : 191.

Kamozi (*Gowdey*), 1913 ; Kampala (*Gowdey*) 1915 ; Bugishu (*Hargreaves*) 1930 ; Serere (*Darling*) 1945 ; Budongo Forest (*Eggeling*)

1944; Mbarara, No. 306, 1937; Toro, No. 311, 1937; Kambuga, Kigezi, No. 485, 1947.

Described by Fuller from specimens collected by Duke in Uganda. The type locality is given as Nkulukuku, but this is also the Luganda name for the termite itself. The locality Kamozi cannot be traced and it is suggested that this is in error for Kamwezi. Though widely distributed throughout Uganda south of latitude 2° North, *C. ugandensis* is not recorded from neighbouring territories.

### *Ophiotermes ugandaensis* Sjostedt.

*Ophiotermes ugandaensis* Sjostedt, 1925, *Konowia* **4** : 54 (preliminary description). Sjostedt, 1925, *Revision:* 266 (soldier).

Mubende, No. 315, 1937, from a low mound by the roadside.

Described by Sjostedt from specimens labelled "Uganda : Kamozi," together with specimens of *Cubitermes ugandaensis* (*q.v.*). Emerson (1928) records it from Garamba, north-eastern Belgian Congo, associated with *Cubitermes antennalis* in a mound described as "a conical structure about 12 inches high . . . doubtless built by *C. antennalis*."

Of the four other species in the genus, three are known only from the Belgian Congo, and one from Tanganyika. In some cases they are recorded as having been found in association with other termites, while in others no specific reference to the situation is made. The workers collected at Mubende had abdomens distended with dark earth, not inconsistent with their having built the low mound in which they were found. Biological data for the whole genus is scanty.

### *Basidentitermes aurivillii* Sjostedt.

*Eutermes aurivillii* Sjostedt, 1897, *Ent. Tidskr.* **18** : 125 (imago). *Eutermes aurivillii* Sjostedt, 1900, *Monogr. Termiten Afrikas* : 159–165 (soldier, worker).

North Bugishu (*Hargreaves*) 1930; Budongo Forest (*Eggeling*) 1944 (No. 444) " from an apparently abandoned nest (of *Termes badius*) all in one small pocket"; Kyagwe County, No. 472, 1946, "nest two inches below surface of soil at base of rubber tree "; Kawanda, No. 474, 1946, "a number of soldiers found in outer wall of *natalensis* mound."

First described from the Cameroons, this species is also recorded from Nigeria and the Gold Coast. Three other species of the genus are restricted to West Africa, one to the western Belgian Congo, and the sixth species to southern Tanganyika Territory.

Sjostedt (1900) figures a "pagoda" mound from the Cameroons as that of *B. aurivillii*. The height of the mound is given as 25 cm. in the text and 45 cm. in the caption to the figure. This is the only reference to mound building in the genus, all other records being either to subterranean galleries or to pockets in the walls of large mounds built by other termites. The colony No. 472 from Kyagwe County consisted of a queen cell and radiating corridors in soil some two inches below ground at the foot of a rubber tree. The workers did not have their abdomens distended with dark moist soil as is usual with mound-building *Cubitermes*. The closely related *B. amicus* Harris has been found in Tanganyika

under similar conditions, and the five species, including *aurivillii* recorded by Silvestri (1914), are all either from "camere e galerie scavate nel terreno vegetale" or "gallerie sotterranee." I consider that Sjostedt's figure is more likely that of an abandoned *Cubitermes* nest which had been taken over jointly by *B. aurivillii*, *Pericapritermes socialis*, and numerous ants as listed in the original account.

## Appendix I.

### *Genera not represented in the List.*

*Microtermes sp. No.* 465.

Butiaba, 1946; from dead stems of shrubs and Aloes on Lake Albert Flats.

*Microtermes sp. No.* 490.

Kawanda, 1946; from buried timbers in "graveyard test" for termite resistance in treated timber.

*Promirotermes sp. No.* 427.

Apala, Lango, 1942 (*Cox*); from a rounded mound about 18 inches high with a central turret nearly 3 feet high.

*Promirotermes sp. No.* 447.

Bugoma Forest, 1944 (*Eggeling*); from long narrow nests built up the trunks of large trees, starting two to three feet from ground level.

*Eutermes sp. No.* 487.

Kambuga, 1947; from arboreal carton nests in dry woodland, northern Kigezi district. Rotting logs on the ground were well infested with soldiers and workers.

*Trinervitermes sp. No.* 464.

Butiaba, 1946; from small low mounds in xerophytic scrub on the Lake Albert flats; most of the mounds examined had been taken over by ants.

*Trinervitermes sp.* No. 488.

Luentobo, 1947; from small low "brain-like" mounds common in the rolling grasslands of south-west Ankole.

*Hodotermes sp. No.* 493.

Moroto, Karamoja District, 1947 (*J. M. Watson*); cutting grass and transporting the pieces to an underground nest.

## Appendix II.

### *Index of the Localities.*

Where the locality given is a county, the position of the county headquarters is given.

| | | | | | |
|---|---|---|---|---|---|
| Apala | 2.25 N. ; 33.02 E. | | Kikandwa | 0.23 N. ; 32.29 E. | |
| Budongo | 1.44 N. ; 31.28 E. | | Kitgum | 3.20 N. ; 32.53 E. | |
| Bugala Island | 0.20 S. ; 32.16 E. | | Kyagwe | 0.21 N. ; 32.45 E. | |
| Bugishu North | 1.10 N. ; 34.17 E. | | Lira ... | 2.15 N. ; 32.54 E. | |
| Bukalasa | 0.43 N. ; 32.31 E. | | Lomej | 3.47 N. ; 33.48 E. | |
| Bulecheke | 1.02 N. ; 34.22 E. | | Luentobo | 1.07 S. ; 30.11 E. | |
| Bulemezi | 0.40 N. ; 32.27 E. | | Lugazi | 0.23 N. ; 32.56 E. | |
| Busu | 0.28 N. ; 33.30 E. | | Masaka | 0.20 S. ; 31.45 E. | |
| Butiaba | 1.50 N. ; 31.20 E. | | Masindi | 1.41 N. ; 31.43 E. | |
| Bwamba | 0.42 N. ; 30.04 E. | | Mbarara | 0.37 S. ; 30.39 E. | |
| Dwoli | 1.30 N. ; 31.21 E. | | Mityana | 0.24 N. ; 32.03 E. | |
| Entebbe | 0.04 N. ; 32.29 E. | | Mpigi | 0.13 N. ; 32.20 E. | |
| Inomo | 2.05 N. ; 32.40 E. | | Mubende | 0.35 N. ; 31.22 E. | |
| Jinja | 0.26 N. ; 33.12 E. | | Ngototwe | 2.24 N. ; 33.27 E. | |
| Kampala | 0.20 N. ; 32.36 E. | | Salalira | 1.14 N. ; 34.17 E. | |
| Kambuga | 0.49 S. ; 29.48 E. | | Serere | 1.31 N. ; 33.27 E. | |
| Kamwezi | 1.13 S. ; 30.13 E. | | Toro | 0.40 N. ; 30.17 E. | |
| Kawanda | 0.25 N. ; 32.32 E. | | Tororo | 0.40 N. ; 34.10 E. | |
| Kazinga Flats | 0.16 S. ; 30.05 E. | | | | |

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# NOTES ON PUPAE OF THE NOCTUIDAE.

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In a recent paper (Gardner, 1946–47) an attempt was made to provide a means of identifying the mature larvae of a number of Indian Noctuidae (or species treated by Hampson as Noctuidae) and the present paper on pupae should be read in conjunction with that.

On the whole the grouping of genera by pupae and by larvae is fairly parallel. In some cases, for example in the Euteliinae, subfamily characters seem more sharply defined in the pupae than in the larvae. The "Acontiinae" of Hampson also have more in common as pupae than as larvae (*Acontia* being excepted) and pupae of Acontiinae and of Sarrothripinae are very similar. In typical Noctuid pupae the appendages do not extend beyond the posterior ventral margin of the fourth abdominal segment or only slightly beyond (Plusiinae); but *Risoba* is peculiar in having the maxillae extending far caudad of segment A4.

I have used the terminology of Mosher (1916), whose important work includes valuable information on Noctuid pupae.

The present paper is something of an afterthought and it is unfortunate that intact pupae of every species were not preserved. Much of my material consists of shells from which adults have emerged and is therefore unsatisfactory for the preparation of keys to genera and species; caudal setae and spines give valuable diagnostic characters, but being usually entangled with silk are particularly liable to damage except with the most careful handling.

The following key will serve to indicate some of the chief categories of pupae.

Key to pupae of Noctuidae.

1. Mesothoracic legs extend to the eye-piece or to the maxillary palp when this is present ... ... ... ... ... ... (2)
   Mesothoracic legs do not extend to the eye-piece ... ... ... (8)

2. Maxillae, mesothoracic legs and antennae produced to base of segment A6 (♀) or beyond the caudal extremity of body (♂). Caudal extremity with small obtuse irregular cremaster. (Head and thorax granulate. A7 with dorsal denticulate transverse ridge. Abdomen with some fine setae) *Risoba* spp. (Sarrothripinae)
   Appendages not extending beyond segment A4 ... ... ... (3)

3. Caudal extremity rounded, without setae, points or cremaster. Basal margin of caudal segment with or without a transverse ridge or series of points ... ... ... ... ... ... (4)
   Caudal extremity with cremaster or with at least two setae ... (5)

4. Prothoracic femora not exposed. Abdomen without asperities or points. (Body well sclerotised, not much less so ventrally) Euteliinae

Prothoracic femora usually exposed. Abdomen with asperities laterally on segment A5 and usually elsewhere; segment A10 often with a transverse ridge or with points ... ... ...
ACONTIINAE (except *Acontia*); SARROTHRIPINAE (except *Eligma*, *Selepa*)

5. Labial palp usually hidden, rarely visible but then extremely narrow. Caudal extremity of body rounded, with two separate setae only. Spiracles broadly oval to subcircular *Larva Group B I*
Without that combination ... ... ... ... ... ... (6)

6. Caudal extremity broadly rounded, smooth, with two divergent spines arising from a common rather thick stalk (fig. 9); fine hooked setae also present. (Femora of T1 not exposed) STICTOPTERINAE
Caudal extremity otherwise ... ... ... ... ... ... (7)

7. Labial palps exposed only as a minute area posterior to labrum. Caudal extremity with eight hooked setae of which the mesal two are longer and stouter ... ... ... ... HERMINIINAE

Labial palp visible as a fusiform area (narrow to absent in *Rhesala* where the mesal caudal setae are not much stronger than the others) . . . CATACOLINAE (most); NOCTUINAE (most); HYPENINAE; ERASTRIINAE, AMPHIPYRINAE (3 genera)

8. Caudal extremity without cremaster, setae or points. Posterior margin of dorsum of A10 with a transverse longitudinally multicarinate ridge. (Femora of leg T1 exposed) ... ... ...
*Selepa*, *Eligma* (SARROTHRIPINAE)

Caudal extremity with setae, often with points, cremaster usually distinct ... ... ... ... ... ... ... ... (9)

9. Femora of legs T1 not exposed ... ... ... ... ... (10)

Femora of legs T1 exposed ... ... ... ... ... ... (12)

10. Labial palps not exposed. (Body rugulose; abdomen rather coarsely punctate. Cremaster an obtuse prominence with two spines which are fine and curved apically) *Brithys* (HADENINAE)
Labial palps exposed ... ... ... ... ... ... ... (11)

11. Body irregular, asperate or rugulose. Cremaster wide, flattened and denticulate or with several straight setae ... AGARISTINAE

Without that combination NOCTUINAE (4 genera), CATACOLINAE (1 genus)

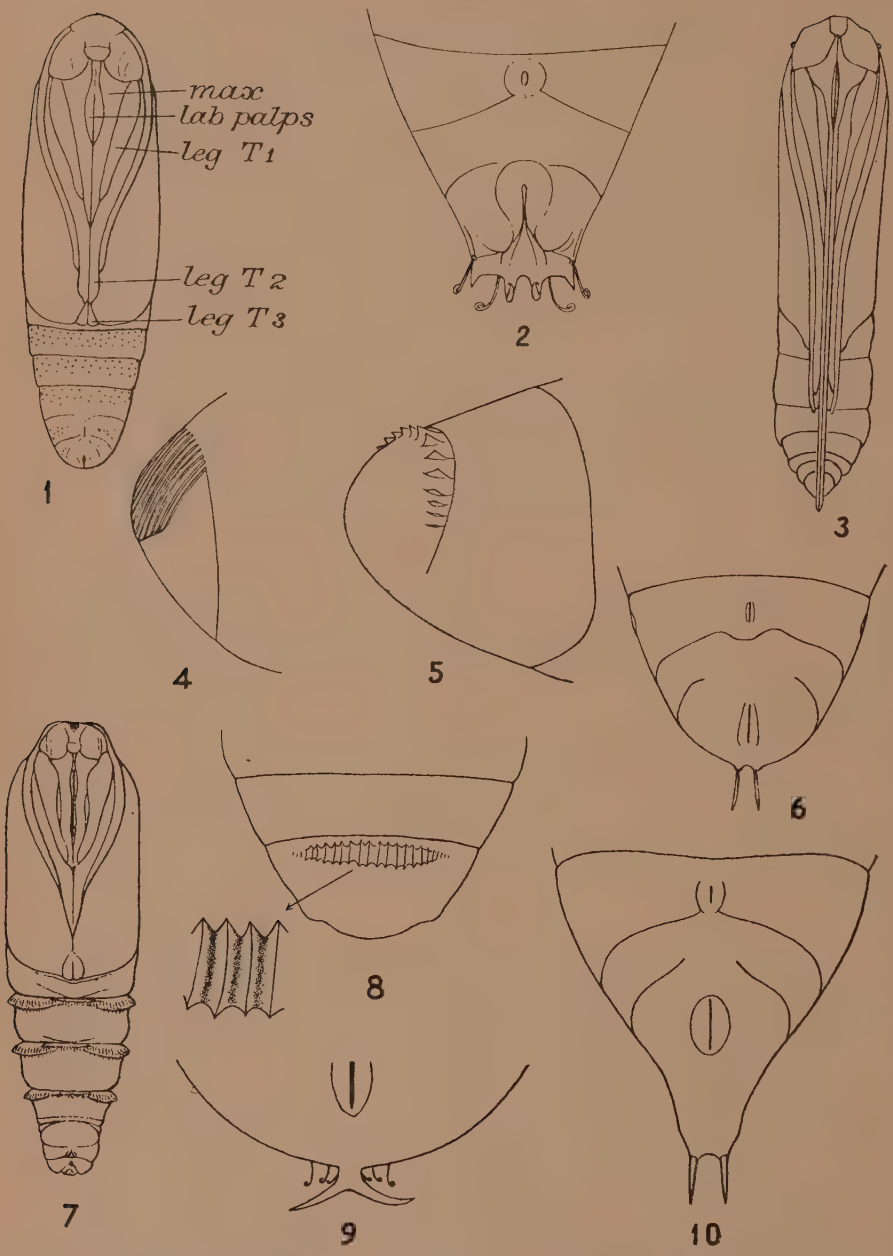
12. Posterior extremity of wings and maxillae produced at meson as a prominence over part of segment A5. (Labrum near apex of body) ... ... ... ... ... ... ... ... PLUSIINAE

Wings and maxillae not thus produced ACRONICTINAE, AMPHIPYRINAE (most), HADENINAE, AGROTINAE, HELIOTHINAE

### HADENINAE, AMPHIPYRINAE, AGROTINAE, HELIOTHINAE.

*Pupae.*—Mesothoracic legs do not reach the eyes. Labial palps exposed. Prothoracic femora exposed. Caudal extremity usually with two spines or points (fig. 10), sometimes with hooked setae. *Cocoons* in soil, lined with silk or a smooth varnish.

The pupae of nearly all the species the larvae of which come into Division A are covered by the above statement. However, several species attributed by Hampson to AMPHIPYRINAE and one to HADENINAE differ.




FIGS. 1–10.—Pupae of NOCTUIDAE. 1, *Chlumetia transversa* Walker, ventral view. 2, *Cosmophila flava* Fabricius, posterior segments, ventral view. 3, *Risoba obstructa* Moore, ventral view. 4, *Eutelia sinuosa* Moore, caudal extremity, lateral view. 5, *Westermannia superba* Hübner, caudal extremity, lateral view. 6, *Androlymnia emarginata* Hampson, posterior segments, ventral view. 7, *Eligma narcissus* Cramer, ventral view. 8, *E. narcissus*, caudal extremity, dorsal view. 9, *Lophoptera illucida* Walker, caudal extremity, ventral view. 10, *Pyrrhia umbra* Hampson, posterior segments, ventral view.

*Chasmina*, *Androlymnia*, *Elydna* (*transversa* Walker) are quite different and support the constitution of "Group B I" on larval structure. In *Callyna*, *Eriopus* and *Iambia* the mesothoracic legs reach the eyes (see couplet 7 in key). *Iambia* further differs in the prothoracic femora being hidden. *Brithys* is isolated as a larva (Division D) and also as a pupa (couplet 10 in key).

### Acronictinae.

*Pupae.*—I have only imperfect pupae of *Diptera champa* Moore and of three species of *Acronicta*. The mesothoracic legs do not reach the eyes. The labial palps and prothoracic femora both exposed. Groups of short setae may be present on certain abdominal segments anterior to caudal extremity or, if absent, the latter with several straight or nearly straight setae.

I provisionally grouped the "naked" larva of *Cetola* with the "hairy" Acronictinae on account of its numerous setae on the prolegs ; the pupa does not support this and agrees with the Amphipyrinae.

The species may be separated as follows :–

1. The transverse cremaster with two long mesal hooked setae and with small hooked setae. (Groups of short setae present on abdomen. Only a small part of legs T3 visible caudal to maxillae. Body shining) ... ... ... ... *Dipthera champa* Moore

   Caudal extremity without two mesal hooked setae. (A considerable part of legs of T3 visible) ... ... ... ... ... (2)

2. Cremaster not distinct. Caudal extremity with four compressed points, two of them on a lower level and wider apart ; with at least four fine straight setae ... ... *Acronicta pruinosa* Guenée

   Cremaster short but distinct ... ... ... ... ... ... (3)

3. Cremaster truncate, with a short point at each extremity and with two points at a higher level ; with numerous fine nearly straight setae. Groups of setae present on preceding abdominal segments *Acronicta bicolor* Moore

   Cremaster weak, more rounded, rugulose, with numerous rather stout slightly curved setae, mostly in two groups. Preceding abdominal segments without groups of setae *Acronicta maxima* Moore

### Agaristinae.

*Pupae.*—Mesothoracic legs do not reach the eye. Labial palps exposed. Prothoracic femora not exposed. Caudal extremity with short but wide cremaster bearing teeth or short setae. Body very rough. Spiracles with anterior margins strongly thickened. Pupal cell in soil.

The pupae examined may be distinguished as follows :

1. Anterior extremity with an abrupt boss. Caudal extremity with at most weak carinae above ... ... ... ... ... ... (2)

   Anterior extremity more evenly rounded. Segment A10 with a dorsal row of strong longitudinal carinae and a ventral row of rather smaller carinae. (Body coarsely asperate, the appendages more finely so) ... ... ... ... *Eusemia adulatrix* Koll

2. Cremaster transversely cariniform, with several straight setae, Surface of abdomen punctate-rugulose ... *Seudyra albifascia* Walker
Cremaster with separate small teeth, bearing setae. Abdomen granulate ... ... ... ... ... *Aegocera venulia* Cramer

### Euteliinae.

*Pupae.*—Mesothoracic legs extend to the eyes. Labial palp exposed (very narrowly in *Anigraea*). Prothoracic femora not exposed. Caudal extremity broadly rounded and smooth, without cremaster and with no setae or points. The body well sclerotised, without asperities. Maxillary palps not visible. *Cocoon* of fine silk covered with particles of earth or (in *Chlumetia*) of wood.

The above combination applies to species of *Anigraea*, *Amyna*, *Chlumetia*, *Paectes*, *Eutelia*, *Bombotelia* and *Phlegetonia*, of which I have described the larvae (Gardner, 1948 (*in press*)); also to *Marathyssa harmonica* Hampson of which I have no larva. While the Euteliinae show sharp subfamily characters as pupae I did not succeed in defining the larvae so precisely although all are in Division C.

The pupa of *Eutelia sinuosa* Moore (fig. 4) is peculiar in having a circular patch of very regular fine longitudinal carinae at the posterior extremity. The pupa of *Chlumetia transversa* Walker is shown in fig. 1.

### Stictopterinae.

*Pupae.*—Mesothoracic legs extend to the eyes. Labial palp exposed. Prothoracic femora not exposed. Caudal extremity (fig. 9) rounded, with two divergent attenuate spines borne together on a thicker median stem; small hooked setae also present. Body well sclerotised, without asperities. Maxillary palp not visible. *Cocoon* of fine silk with soil covering.

This combination of characters distinguishes the pupae of *Lophoptera* (*costata* Moore, *illucida* Walker) and *Odontodes* (*aleuca* Guenée) from any others I have seen. The larvae of the two genera show rather remarkable differences (Gardner, 1948 (*in press*)).

### Plusiinae.

*Pupae.*—Mesothoracic legs do not reach the eyes. Labial palps exposed. Prothoracic femora exposed. Wings and maxillae, at their posterior extremity, forming a rounded prominence which projects beyond the posterior margin of the fourth abdominal segment. Labrum more anterior than usual, near cephalic extremity. Cremaster well developed, more or less cylindrical, with two long and four short hooked setae (according to Mosher 1916 : 115; the longer setae are broken in my specimens). *Cocoons* of fine silk between folded leaves.

This diagnosis applies to pupae of *Plusia* species and of *Abrostola anophioides* Moore; in the latter sharply defined granules are present on the anterior abdominal terga. Larvae, with biordinal crochets, are in Group B III.

### "Acontiinae."

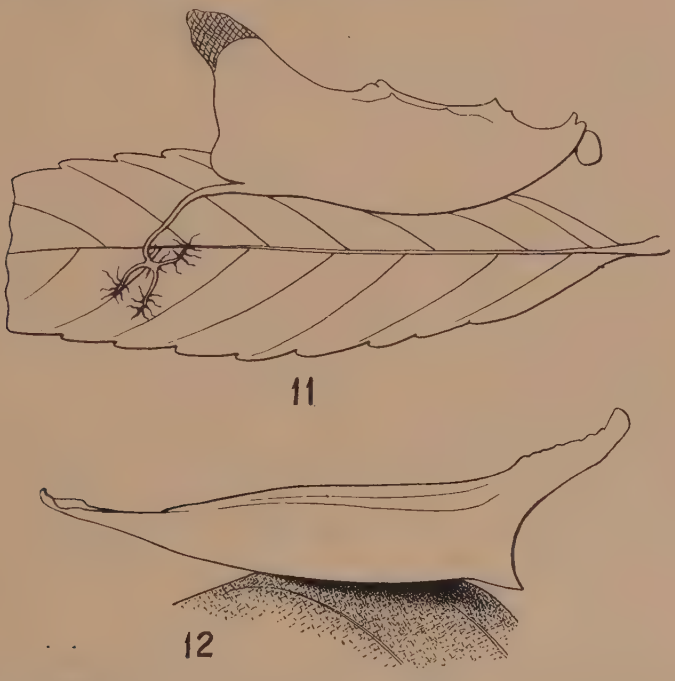
*Pupae.*—Mesothoracic legs extend to eye-piece. Labial palp exposed. Prothoracic femora exposed. Caudal extremity broadly rounded, without cremaster setae or points. At least fifth abdominal segment with lateral asperities. Body darker above than below (slightly in *Westermannia*, *Beana*). *Cocoon* exposed, of closely woven silk (looser and in soil in cases of *Westermannia* and *Beana*).

Although I have dispersed the larvae of the genera examined among more than one group, the pupae have a great deal in common and are distinct from all others except the SARROTHRIPINAE. *Acontia*, however, is quite different both in the pupal and larval stages (see Larva Group B I).

In some genera the posterior margin of segment A10 may have a row of longitudinal carinae or points which is incomplete ventrally and sometimes elsewhere, such are : *Westermannia*, *Beana* (a penellipse of points or prominent carinae, see fig. 5) ; *Earias* (two or three lateral carinae on each side distinct) ; *Plagiograpta* (a fine dorsal transverse ridge).

In *Aitelta*, *Carea*, *Maurilia*, *Pseudelydna* (larvae in group A V) and in *Churia* (larva group A VI) there is no distinct specialisation of segment A10.

Larvae have setal group VII bisetose on A1, trisetose on A2 and the ventral prolegs equal, but in *Beana* (Group B IV C) VII is trisetose on both segments and the anterior prolegs are reduced.




FIGS. 11, 12.—Cocoons of SARROTHRIPINAE. 11, *Gabala polyspilalis* Walker, showing stalked attachment to leaf. 12, *Labanda semipars* Walker.

### SARROTHRIPINAE.

*Pupae.*—As in "ACONTIINAE" except that the prothoracic femora are hidden in a few genera. *Cocoons* exposed, of tough silk, the shape varying with the genus (figs. 11, 12).

The above statement applies to *Characoma*, *Garella*, *Giaura*, *Symitha*, *Labanda*, *Blenina*, *Sarrothripus* ; in all but the first two there is a

transverse row of carinae on posterior margin of A10 which is discontinuous dorsally in *Sarrothripus sinuosa* Moore (but continuous in *S. revayana* Scopoli) and in *Symitha*.

*Selepa* and *Eligma* are closely related to one another (as are the larvae, Division D) and do not fit here since the mesothoracic legs do not reach the eyes, although allied to SARROTHRIPINAE in the other respects. In each A10 has a well-defined dorsal transverse ridge with short longitudinal carinae (figs. 7, 8).

In *Risoba* (fig. 3) the head appendages are extremely long, extending over segment A5 (♀) or beyond the caudal extremity of the body (♂); also there is a weakly developed obtuse cremaster apparently without setae although there are some on the more anterior segments. Segment A7 with a dorsal denticulate transverse ridge. Body slenderly cylindrical.

### ERASTRIINAE.

*Pupae.*—Mesothoracic legs extend to the eye. Labial palps exposed. Prothoracic femora exposed or not. Caudal extremity with or without two or more hooked setae, sometimes with four small points or teeth.

Available pupae are not in good enough condition for further comments; they represent all the species discussed as larvae under Group B IV. Pupae of *Amyna* spp. fit into "Larva Group B I."

### HYPENINAE.

*Pupae.*—Mesothoracic legs extend to eye. Labial palps distinct. Prothoracic femora not visible. Caudal extremity with short cremaster and with eight hooked setae, of which the mesal two are longer and thicker. Apices of legs T3 exposed posterior to maxillae which do not extend as far caudad as legs of T2. Apices of wings well separated from maxillae. Spiracles raised. Without bloom. *Cocoons* of silk in soil; sometimes between folded leaves.

The above applies to all species of the genera *Bomolocha*, *Dichromia*, *Harita*, *Hypena*, *Rhynchina*, the larvae of which I have discussed as Group B II (Gardner, 1946[a]: 69). I excluded the larva of *Hypena aurotincta* Hampson from that group; however, the pupa is not very different although it may be distinguished by having a prominent boss at the anterior extremity of the body. The pupa of *Rhynchodontodes angulata* Hampson is very different, the cremaster having two well-separated teeth as well as fine hooked setae; the head with two strong bosses.

### HERMINIINAE.

*Pupae.*—Mesothoracic legs reach the eye. Labial palps visible only as a minute triangle contiguous with labrum except in *Hydrillodes* in which the palps are extremely narrow. Prothoracic femora not exposed. Caudal extremity with short cremaster and with eight hooked setae, the two mesal stout, the others shorter, much finer. Maxillae extend to or nearly to posterior margin of segment A4, at most a minute part of legs T3 being visible. Tips of wings pointed mesally and meeting apices of maxillae. Legs of T2 not extending as far caudad as maxillae. Without bloom. *Cocoons* of thick silk in soil particles.

The above applies to genera of which I have examined the larvae (Gardner, 1948 (*in press*)), namely *Bertula*, *Simplicia*, *Hydrillodes*, *Hipoepa*, *Progonia*, *Nodaria*, *Herminia*. The subfamily seems well defined in both larval and pupal stages.

### Catacolinae.

*Pupae.*—Mesothoracic legs extend to the eye. Labial palps exposed. Prothoracic femora not exposed. Caudal extremity with cremaster and with eight (or perhaps six in some) hooked setae, the mesal two usually longer. With or without bloom. *Cocoons* usually in leaves spun together with silk.

This applies to species of *Achaea*, *Anua*, *Enmonodia*, *Mocis*, *Ophiusa*, *Parallelia*, *Pericyma*, *Speiredonia*; the larvae of these come into Group B IV (Gardner, 1948 (*in press*) ). Some species of Noctuinae are very similar.

The only available pupa of *Cocytodes* (the larva of which is in Division C), which is imperfect, has two approximate capitate rods at the caudal extremity and no other setae, but these may have been broken; the prothoracic femora are narrowly exposed; the body highly polished; in this pupa the maxillary palp is visible.

In *Plecopterodes* the legs of T2 do not extend to the eye; the pupa is separated from four genera of Noctuinae, to which this also applies, under the next heading.

### Noctuinae.

*Pupae.*—Mesothoracic legs extend to eyes. Labial palps visible (very narrow in *Anomis*, *Rhesala*. (Prothoracic femora usually concealed (*Plecoptera*, *Ericeia* are exceptions). Caudal extremity with cremaster and with eight hooked setae usually of two sizes but in *Marcillada* only two stout points seem to be present. Spiracles narrow. Bloom sometimes present.

This applies to most of the genera examined the larvae of which are in Group B IV or in Division C. There appears to be no marked distinction from the Catacolinae.

*Bocula megastigmata* Hampson, *B. hypenoides* Moore and *Oglasa separata* Walker are very different and are discussed under Larva Group B I.

Four genera of Noctuinae and one of Catacolinae in which the legs of T2 do not reach the eye may be distinguished as follows:

1. Pronotum produced anteriorly and extending beyond the head; carinate along the median line. Caudal extremity rounded but dorsally with two widely separated groups each of three spines *Diomea* sp.
   Pronotum not produced anteriorly beyond the head ... ... (2)
2. Head with a strong median boss or tubercle which forms the anterior extremity of the body. (Cremaster (fig. 2) wide, its lateral extremities each with a sharp caudad spine and, at a lower level, two long subapproximate downward curved spines; fine hooked setae also present) *Cosmophila* (*flava* F., *lyona* Swinhoe)
   Cephalic extremity evenly rounded ... ... ... ... ... (3)
3. Cremaster without spines, with hooked setae two of which are approximate and longer ... ... *Throana pectinifer* Hampson[1]
   Cremaster with two or four spines ... ... ... ... ... (4)
4. Cremaster with a fine attenuate spine at each extremity. Abdomen rather coarsely punctate ... ... *Plecopterodes pulchra* Fabricius
   Cremaster with two rather short, basally flattened teeth; at a lower level are two more widely separate similar teeth. Body polished; abdomen finely punctate *Oraesia* (*emarginata* Fabricius, *rectistria* Guenée)

[1] This species was referred to as *Zethes pectinifer* Hampson in the paper on larvae.

## Larva Group B I.

This group contains certain species which although distributed among four subfamilies by Hampson seem to form a well-defined subfamily on characters of the larva (Gardner, 1946[a] : 65).

*Pupae.*—The mesothoracic legs extend to the eye. Labial palp not exposed (but very narrowly so in one species). Prothoracic femora either not visible or extremely narrowly exposed. Caudal extremity rounded, with two separate straight setae each in a very small to fairly large tubercle ; there are no other setae. Spiracles broadly oval. Body well sclerotised, without asperities, without bloom. *Cocoon* of silk with soil covering.

The above applies to the species I have placed in Group B I on larval characters and belonging to the genera *Acontia*, *Amyna*, *Androlymnia* (fig. 6), *Bocula*, *Chasmina*, *Elydna* (*transversa* Walker) and *Oglasa*. There is one exception, namely the unidentified species referred to as *G.* 5664 ; in the pupa of this species the caudal extremity bears several (? eight) hooked setae and the spiracles are narrow ; the larva has heteroideous crochets which fact distinguishes it from the other species.

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1948

WEDNESDAY, July 7
,, September 1
,, October 6
,, November 3
,, December 1

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